Ordinance & Syllabus

For

M.Sc. – MLT
Academic Programme

Specialization/Discipline:

Clinical Biochemistry
Medical Microbiology & Immunology
Pathology

Ordinance According to
NEP-2020

Duration:
2 years (4 Semesters)

M.Sc. – Medical Laboratory Technology (MLT)

Clinical Biochemistry

Program outcome

At the end of the course the student should be able to:

- Supervise/Perform routine Clinical Biochemistry laboratory testing.
- Provide Medical laboratory services in all types of clinical laboratories from Primary healthcare laboratory to Tertiary health care institution in the fields of Bacteriology, Immunology, Mycology, Parasitology and Virology.
- Make specimen-oriented decision on predetermined criteria including working knowledge of critical values.
- Communicate with other members of healthcare team, customers and patients in an effective manner.
- Process information and ensure quality control as appropriate to routine laboratory.
- Train students in routine/special laboratory procedure.
- Upgrade knowledge and skills in a changing healthcare scenario.
- Should know the logical interpretation of clinical lab investigations.
- Should be capable to extrapolate data acquired
- Should be capable of supervise / guide the staff working on automated machine
- Should be capable of teaching, proposing/executing research project

Program Specific outcome

- Proficiently supervise and perform full range of clinical Biochemistry laboratory tests.
- Develop and evaluate test systems and interpretive algorithms.
- Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information
- To teach under graduate students and develop/guide research projects
- Faculty development in Medical Laboratory Technology (MLT)

Medical Microbiology & Immunology

Program Outcome

At the end of the course the student should be able to:

- To provide medical laboratory services in all types of clinical laboratories from Primary healthcare laboratory to Tertiary health care institution in the fields of Bacteriology, Immunology, Mycology, Parasitology and Virology.
- Make specimen-oriented decision on predetermined criteria including working knowledge of critical values.
- Communicate with other members of healthcare team, customers and patients in an effective manner.
- Process information andensure quality control as appropriate to routine laboratory.
- Train students in routine/special laboratory procedure.
- Upgrade knowledge and skills in a changing healthcare scenario.
- Should know the logical interpretation of clinical lab investigations.
- Should be capable to extrapolate data acquired
- Should be capable of supervise / guide the staff working on automated machine
- Should be capable of teaching, proposing/executing research project

Program Specific outcome

- Proficiently supervise and perform full range of clinical laboratory investigations related to Medical Microbiology, hence provide medical laboratory services in all types of clinical laboratories from Primary healthcare laboratory to Tertiary health care institution in the fields of Bacteriology, Immunology, Mycology, Parasitology and Virology.
- Develop and evaluate test systems and interpretive algorithms.
- Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information.
- To teach under graduate students and develop/guide research projects.
- Faculty development in Medical Laboratory Technology (MLT).

Pathology

Program Outcome

At the end of the course the student should be able to:

- Supervise/Perform routine Haematological and Immuno-haematological laboratory testing.
- Make specimen-oriented decision on predetermined criteria including working knowledge of critical values.
- Communicate with other members of healthcare team, customers and patients in an effective manner.
- Process information and ensure quality control as appropriate to routine laboratory.
- Train students in routine/special laboratory procedure.
- Upgrade knowledge and skills in a changing healthcare scenario.
- Should know the logical interpretation of clinical lab investigations.
- Should be capable to extrapolate data acquired
- Should be capable of supervise / guide the staff working on automated machine
- Should be capable of teaching, proposing/executing research project

Program specific outcome

- Proficiently supervise and perform full range of Haematological and Immuno-haematological laboratory tests.
- Develop and evaluate test systems and interpretive algorithms.
- Manage information to enable effective, timely, accurate, and cost-effective reporting of laboratory-generated information
- To teach under graduate students and develop/guide research projects
- Faculty development in Medical Laboratory Technology (MLT)

Master of Science in Medical Laboratory Technology
(M.Sc.-MLT)

1. Duration of Course:

- M.Sc.-MLT course will be a full-time course.
- Duration will be two years (Four Semesters).

This course shall be divided into four semester examinations namely MSc in Medical Laboratory Technology I & II Semester (First Academic Year), & III & IV Semester (Second Academic Year) .

2. Specialization/Discipline

There shall be following specialization/discipline:

Specialization/ Discipline	No. of Seats
M.Sc.-MLT in Clinical Biochemistry	**10**
M.Sc.-MLT in Medical Microbiology & Immunology	**10**
M.Sc.-MLT in Pathology	**10**

MEDIUM OF INSTRUCTION

English shall be the medium of instruction for all the subjects of study and for examination of the course.

SEATS:

Total no. of seats will be 30.

EXAMINATION:

As per the University norms.

DURATION OF EXAMINATION:

As per the University norms.

ELIGIBILITY:

The students who have passed B.Sc.-MLT (B.Sc.-Medical Laboratory Technology) Course from any recognized Institutions/University with minimum of 55% marks (50% for SC/ST)

CHHATRAPATI SHAHU JI MAHARAJ UNIVERSITY, KANPUR

STRUCTURE OF SYLLABUS FOR THE

PROGRAM: M.Sc.-Medical Laboratory Technology (MMLT)

Syllabus Developed by			
Name of BoS Convenors / BoS Members	**Designation**	**Department**	**College/University**
Prof. Sanjay Kala	Principal	Dean, Faculty of Medicine	GSVM. Medical College, Kanpur
Prof. Dolly Rastogi	Professor	Physiology	GSVM Medical College, Kanpur
Prof. Parvez Khan	Head	Ophthalmology	GSVM Medical College, Kanpur
Prof. Sanjay Kumar	Head	Orthopaedics	GSVM Medical College, Kanpur
Prof. MP Mishra	Ex. Director	JK Cancer Institute	GSVM Medical College, Kanpur
Dr. Chayanika Kala	Associate Professor	Pathology	GSVM Medical College, Kanpur
Dr. Ashok Verma	Head & Associate Professor	Radiology	GSVM Medical College, Kanpur
Dr. Digvijay Sharma	Director	School of Health Sciences	CSJM University, Kanpur
Dr. Munish Rastogi	Assistant Director	School of Health Sciences	CSJM University, Kanpur
Dr. Versha Prasad	Assistant Professor	School of Health Sciences	CSJM University, Kanpur
Dr. Ram Kishor	Assistant Professor	School of Health Sciences	CSJM University, Kanpur

Subjects: Clinical Biochemistry, Pathology, Medical Microbiology and Immunology

	IST YEAR / IST SEM					
COURSE CODE	**TYPE**	**COURSE TITLE**	**CREDITS**	**CIA**	**ESE**	**MAX. MARKS**
M010701T	CORE	MEDICAL BIOCHEMISTRY	4	25	75	100
M010702T	CORE	CLINICAL PATHOLOGY & IMMUNOPATHOLOGY	4	25	75	100
M010703T	CORE	GENERAL MICROBIOLOGY	4	25	75	100
M010704T	CORE	RESEARCH METHODOLOGY	4	25	75	100
M010705P	PRACTICAL	MEDICAL BIOCHEMISTRY	4	25	75	100
M010706P	PRACTICAL	CLINICAL PATHOLOGY & IMMUNOPATHOLOGY	4	25	75	100
M010707P	PRACTICAL	GENERAL MICROBIOLOGY	4	25	75	100
	DISSERTATION	DISSERTATION	0			
	TOTAL		**28**			**700**
IST YEAR / IIND SEM						
M010801T	CORE	MEDICAL LABORATORY MANAGEMENT	4	25	75	100
M010802T	CORE	BLOOD GROUPING & IMMUNOLOGY	4	25	75	100
M010803T	CORE	BIOMEDICAL TECHNIQUES	4	25	75	100
M010804T	CORE	BIOSTATISTICS	4	25	75	100
M010805P	PRACTICAL	MEDICAL LABORATORY MANAGEMENT	4	25	75	100
M010806P	PRACTICAL	BLOOD GROUPING & IMMUNOLOGY	4	25	75	100
M010807P	PRACTICAL	BIOMEDICAL TECHNIQUES	4	25	75	100
M010808R	DISSERTATION	DISSERTATION	8	25	75	100
	TOTAL		**36**			**800**

Subjects: Clinical Biochemistry

	IInd YEAR / IIIrd SEM					
COURSE CODE	**TYPE**	**COURSE TITLE**	**CREDITS**	**CIA**	**ESE**	**MAX. MARKS**
M01C0901T	CORE	CLINICAL BIOCHEMISTRY	4	25	75	100
M01C0902T	CORE	ENDOCRINOLOGY	4	25	75	100
M01C0903T	CORE	TUMOUR AND CANCER MARKER	4	25	75	100
M01C0904P	PRACTICAL	CLINICAL BIOCHEMISTRY	4	25	75	100
M01C0905P	PRACTICAL	ENDOCRINOLOGY	4	25	75	100
M01C0906P	PRACTICAL	TUMOUR AND CANCER MARKER	4	25	75	100
	DISSERTATION	DISSERTATION	0			
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	2			
		CLINICAL TRAINING/ CAMPS	2			
	TOTAL		**28**			**600**
IInd YEAR / IVrd SEM						
M01C1001T	CORE	APPLIED BIOCHEMISTRY	4	25	75	100
M01C1002T	CORE	AUTOMATION	4	25	75	100
M01C1003P	PRACTICAL	APPLIED BIOCHEMISTRY	4	25	75	100
M01C1004P	PRACTICAL	AUTOMATION	4	25	75	100
M01C1005R	DISSERTATION	DISSERTATION	8	25	75	100
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	2			
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	2			
	TOTAL		**28**			**500**
	Grand Total		**120**			**2600**

Subjects: Medical Microbiology & Immunology

	IInd YEAR / IIIrd SEM					
COURSE CODE	**TYPE**	**COURSE TITLE**	**CREDITS**	**CIA**	**ESE**	**MAX. MARKS**
M01M0901T	CORE	SYSTEMIC BACTERIOLOGY	4	25	75	100
M01M0902T	CORE	VIROLOGY	4	25	75	100
M01M0903T	CORE	MYCOLOGY	4	25	75	100
M01M0904P	PRACTICAL	SYSTEMIC BACTERIOLOGY	4	25	75	100
M01M0905P	PRACTICAL	VIROLOGY	4	25	75	100
M01M0906P	PRACTICAL	MYCOLOGY	4	25	75	100
	DISSERTATION	DISSERTATION	0			
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	2			
		CLINICAL TRAINING/ CAMPS	2			
	TOTAL		**28**			**600**
IInd YEAR / IVrd SEM						
M01M1001T	CORE	APPLIED MICROBIOLOGY & IMMUNOLOGY	4	25	75	100
M01M1002T	CORE	PARASITOLOGY	4	25	75	100
M01M1003P	PRACTICAL	APPLIED MICROBIOLOGY & IMMUNOLOGY	4	25	75	100
M01M1004P	PRACTICAL	PARASITOLOGY	4	25	75	100
M01M1005R	DISSERTATION	DISSERTATION	8	25	75	100
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	2			
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	2			
	TOTAL		**28**			**500**
	Grand Total		**120**			**2600**

Subjects: Pathology

	IInd YEAR / IIIrd SEM					
COURSE CODE	**TYPE**	**COURSE TITLE**	**CREDITS**	**CIA**	**ESE**	**MAX. MARKS**
M01P0901T	CORE	HISTOPATHOLOGY	4	25	75	100
M01P0902T	CORE	HEMATOLOGY	4	25	75	100
M01P0903T	CORE	BLOOD BANK PROCEDURES	4	25	75	100
M01P0904P	PRACTICAL	HISTOPATHOLOGY	4	25	75	100
M01P0905P	PRACTICAL	HEMATOLOGY	4	25	75	100
M01P0906P	PRACTICAL	BLOOD BANK PROCEDURES	4	25	75	100
	DISSERTATION	DISSERTATION	0			
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	2			
		CLINICAL TRAINING/ CAMPS	2			
	TOTAL		**28**			**600**
IInd YEAR / IVrd SEM						
M01P1001T	CORE	COAGULATION STUDIES	4	25	75	100
M01P1002T	CORE	BLOOD TRANSFUSION	4	25	75	100
M01P1003P	PRACTICAL	COAGULATION STUDIES	4	25	75	100
M01P1004P	PRACTICAL	BLOOD TRANSFUSION	4	25	75	100
M01P1005R	DISSERTATION	DISSERTATION	8	25	75	100
		TEACHING SKILLS/SEMINARS/SYMPOSIA/JOURNAL CLUB ETC.	2			
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	2			
	TOTAL		**28**			**500**
	Grand Total		**120**			**2600**

NOTE:

1. **Do not mark any Code/Information in Column-A, it will be endorsed by the University.**
2. **CIA** in Column-E stands for **'Continuous Internal Assessment'** and depicts the maximum internal marks. Respective examination will be conducted by subject teacher. **ESE** in Column F stands for **'End Sem Examination/Evaluation'** and depicts the maximum external marks. Respective examination will be conducted by the University.
3. Column-B defines the nature of course/paper. The word **CORE** herein stands for **Compulsory Subject Paper**.
4. Column-D depicts the credits assigned for the corresponding course/paper.
5. **Elective:** It will be a Subject Elective. Students may accordingly select one or more subject papers under this category.
6. **Amongst the electives, one or two electives may be declared as Open (Generic) electives that shall be open as Minor Elective to students of other faculty in 1st or 2nd semester of a PG program.**
7. In both years of PG program, there will be a Research Project or equivalently a research-oriented Dissertation as per guidelines issued earlier.
8. Research project can be done in form of Internship/Survey/Field work/Research project/ Industrial training, for which report/dissertation shall have to be submitted. The evaluation for the same shall be done at the end of each year in form of seminar/presentation and viva voce.
9. The student straight away will be awarded 05 credits if he publishes a research paper on the topic of Research Project or Dissertation.

Internal Assessment

- It will be for theory and practical both.
- It will be done through the whole semester
- Candidate must obtain at least 40% marks in theory and practicals separately in internal assessment to be eligible for the semester university examination.

- Internal assessment (Theory) will be done as follows:

a)	Seminars/Symposia/Journal club/Assignment/ Clinical presentation	= 10 marks
b)	Mid-term examination	= 10 marks
c)	Attendance/Teaching Skills	= 05 marks
		Total = 25 marks

- Internal assessment (Practical) will be done as follows:

a)	Lab work Presentation /Clinical Lab Practices/Clinical Training	= 10 marks
b)	Practical Training Skills/ Continuous evaluation	= 10 marks
c)	Laboratory Manual/Attendance	= 05 marks
		Total = 25 marks

- Internal assessment of subjects without practical will be done as:

a)	Assignments/ Projects/ class test/ Presentations	= 10 marks
b)	Mid Term examination	= 10 marks
c)	Attendance/Teaching Skills	= 05 marks
		Total = 25 marks

Criteria for Passing

- As per University norms.

Maximum duration for completion for course

- A candidate shall complete the course within four years from date of admission failing which the candidate will be discharged.

Division:

- As per the University norms.

Degree:

- The degree of M.Sc.-MLT course of the University shall be conferred according to specialization/discipline on the candidates who have pursued the prescribed course of study for not less than two academic years and have passed examinations as prescribed under the relevant scheme.

Monitoring Progress of Studies

It is essential to monitor the learning progress of each candidate through continuous appraisal and regular internal assessment. It not only also helps teachers to evaluate students, but also students to evaluate themselves. The monitoring be done by the faculty members of the department based on participation of students in various teaching / learning activities.

(a) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars in a semester (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(b) Clinical Lab Practices

Post graduate students must do:

- Sample collection, storages & analysis of every sample given to them for various parameters.
- They should know proper laboratory management.
- They should work on every instrument according to their specialization.
- Maintenance and care of the instrument of the laboratory.
- They will do hospital/laboratory/blood bank postings for training & skill development.

(c) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(d) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(e) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the student.

(f) Mid Term Examination/Class Test/Assignments

There will be mid-term examination/class tests/ assignments in every semester. Various class test may be taken by the department and assignments may be given to students on various topics. Marks of these will be included in every semester.

(g) Records

Records, log books and marks obtained in mid-term examination/class tests/ assignments will be maintained by the Head of the Department/Teacher of the concerned subject.

Dissertation

Every candidate pursing M.Sc.-MLT degree course is required to carry out research work on a selected research project under the guidance of a recognized postgraduate teacher. The results of such a work shall be submitted in the form of dissertation. Topic for dissertation shall be assigned by the guide.
If the subject of Thesis entails collaboration with other departments or specialties, the collaborative portion of the work will be supervised by Co-Guide, designated by the School of Health Sciences in consultation with the Guide. Where a Co-Guide is involved, the Thesis will be certified jointly by the Guide & Co-guide.

Every candidate shall submit synopsis to the University in the prescribed Performa containing particulars of proposed dissertation work, within 6 months from the date of commencement of the course on or before the dates notified by the university. The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the university will register the dissertation topic.
No change in the dissertation topic or guide shall be made without prior approval of the university. Guide will be only a facilitator, advisor of the concept and hold responsible in correctly directing the candidate in the methodology and not responsible for the outcome and results.

The dissertation should be written under the following headings.

1. Introduction
2. Aims or objectives of study
3. Review of literature
4. Material and methods
5. Results
6. Discussion
7. Conclusion
8. References
9. Master and Chart & Table (If Applicable)
10. Annexure (If Applicable)

The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 120 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of bond paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for having done the work himself should also be included, and the guide, head of the department and Director/Coordinator of the institute shall certify the dissertation/ research project.
Every candidate is required to give power point presentation before final submission of dissertation. Four copies of Dissertation/research project shall be submitted to the university, through proper channel, along with a soft copy (CD), 2 months before the final examination. It shall be assessed by two examiners appointed by the university, one internal and one external. There will be a power point open presentation of the submitted dissertation as per the schedule given by the university. This presentation shall be jointly evaluated by external and internal examiner as per the criteria given below:
Objective(s) of the work done, Methodology adopted, Result and Discussion, Conclusion & outcome
If the student failed to secure the minimum passing marks he will resubmit the dissertation 01 month before the supplementary exam.

Guide

I. Eligibility to be a guide

(a) Full time faculty involved in teaching in the same Department/Institute or in the affiliated colleges or institutions of University.

(b) Academic qualification and teaching/professional experience for each branch.

For M.Sc.-MLT in Clinical Biochemistry

- MBBS, MD (Medical Biochemistry)/MBBS, M.Sc. (Medical/Clinical Biochemistry with 02 years teaching/professional experience.
  Or
  MBBS, Ph.D. (Faculty of Medicine) with 2 years teaching/professional experience in related subject.
  Or
  MBBS/Ph.D.(Life Science) with 5 years teaching experience in related subject.
  Or
  M.Sc. (Medical/Clinical Biochemistry) or M.Sc.-MLT in Clinical Biochemistry with 05 years of teaching experience after the postgraduate qualification in a teaching institute.

- **For M.Sc.-MLT in Medical Microbiology & Immunology**
  MBBS, MD (Medical Microbiology)/M.B.B.S, M.Sc.-in Medical Microbiology with 02 years teaching/professional experience.
  Or
  MBBS, Ph.D. (Faculty of Medicine) with 02 years teaching/professional experience in related subject.
  Or
  MBBS with 5 years teaching experience in related subject.
  Or
  MBBS/Ph.D.(Life Science) with 5 years teaching experience in related subject.
  Or
  M.Sc. (Medical Microbiology) or M.Sc.-MLT in Microbiology and Immunology/related subject with 5 years teaching experience after the post graduate qualification in teaching institute.

- **For M.Sc.-MLT in Pathology**
  MBBS, MD (Pathology) with 02 years teaching/professional experience.
  Or
  MBBS, Ph.D. (Faculty of Medicine) with 02 years teaching/professional experience in related subject.
  Or
  MBBS with 5 years teaching experience in related subject.
  Or
  M.Sc.-MLT in Pathology or related subject with 5 years teaching experience after the post graduate qualification in teaching institute.

The Vice Chancellor of the University can appoint a person as a guide whom he/she considers suitable.

II. Age of Guide

The age of guide should not exceed 62 years or as per university norms.

III. Guide student ratio

1: 5

A recognized guide shall supervise dissertation work of not more than 5 students per academic year.

IV. Change of Guide

In the event of registered guide leaving the department/institute or in the event of death of guide, guide may be change with prior permission from the university.

COURSE OF STUDY

Specialization- Clinical Biochemistry/Pathology/Medical Microbiology & Immunology

First Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M010701T	CORE	MEDICAL BIOCHEMISTRY	80
M010702T	CORE	CLINICAL PATHOLOGY & IMMUNOPATHOLOGY	80
M010703T	CORE	GENERAL MICROBIOLOGY	80
M010704T	CORE	RESEARCH METHODOLOGY	80
M010705P	PRACTICAL	MEDICAL BIOCHEMISTRY	80
M010706P	PRACTICAL	CLINICAL PATHOLOGY & IMMUNOPATHOLOGY	80
M010707P	PRACTICAL	GENERAL MICROBIOLOGY	80
	DISSERTATION	DISSERTATION	40
		TOTAL	**600**

Second Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M010801T	CORE	MEDICAL LABORATORY MANAGEMENT	80
M010802T	CORE	BLOOD GROUPING & IMMUNOLOGY	80
M010803T	CORE	BIOMEDICAL TECHNIQUES	80
M010804T	CORE	BIOSTATISTICS	80
M010805P	PRACTICAL	MEDICAL LABORATORY MANAGEMENT	80
M010806P	PRACTICAL	BLOOD GROUPING & IMMUNOLOGY	80
M010807P	PRACTICAL	BIOMEDICAL TECHNIQUES	80
M010808R	DISSERTATION	DISSERTATION	120
		TOTAL	**680**

M.Sc.-MLT (Clinical Biochemistry)

Third Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M01C0901T	CORE	CLINICAL BIOCHEMISTRY	80
M01C0902T	CORE	ENDOCRINOLOGY	80
M01C0903T	CORE	TUMOUR AND CANCER MARKER	80
M01C0904P	PRACTICAL	CLINICAL BIOCHEMISTRY	80
M01C0905P	PRACTICAL	ENDOCRINOLOGY	80
M01C0906P	PRACTICAL	TUMOUR AND CANCER MARKER	80
	DISSERTATION	DISSERTATION	40
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL TRAINING/ CAMPS	160
		TOTAL	**720**

M.Sc.-MLT (Clinical Biochemistry)

Fourth Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M01C1001T	CORE	APPLIED BIOCHEMISTRY	80
M01C1002T	CORE	AUTOMATION	80
M01C1003P	PRACTICAL	APPLIED BIOCHEMISTRY	80
M01C1004P	PRACTICAL	AUTOMATION	80
M01C1005R	DISSERTATION	DISSERTATION	120
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	160
		TOTAL	**640**

Specialization- Medical Microbiology & Immunology

M.Sc.-MLT (Medical Microbiology & Immunology)

Third Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	Teaching Hours
M01M0901T	CORE	SYSTEMIC BACTERIOLOGY	80
M01M0902T	CORE	VIROLOGY	80
M01M0903T	CORE	MYCOLOGY	80
M01M0904P	PRACTICAL	SYSTEMIC BACTERIOLOGY	80
M01M0905P	PRACTICAL	VIROLOGY	80
M01M0906P	PRACTICAL	MYCOLOGY	80
	DISSERTATION	DISSERTATION	40
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL TRAINING/ CAMPS	160
		TOTAL	**720**

M.Sc.-MLT (Medical Microbiology & Immunology)

Fourth Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M01M1001T	CORE	APPLIED MICROBIOLOGY & IMMUNOLOGY	80
M01M1002T	CORE	PARASITOLOGY	80
M01M1003P	PRACTICAL	APPLIED MICROBIOLOGY & IMMUNOLOGY	80
M01M1004P	PRACTICAL	PARASITOLOGY	80
M01M1005R	DISSERTATION	DISSERTATION	120
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	160
		TOTAL	**640**

Specialization- Pathology

M.Sc.-MLT (Pathology)

Third Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	TEACHING HOURS
M01P0901T	CORE	HISTOPATHOLOGY	80
M01P0902T	CORE	HEMATOLOGY	80
M01P0903T	CORE	BLOOD BANK PROCEDURES	80
M01P0904P	PRACTICAL	HISTOPATHOLOGY	80
M01P0905P	PRACTICAL	HEMATOLOGY	80
M01P0906P	PRACTICAL	BLOOD BANK PROCEDURES	80
	DISSERTATION	DISSERTATION	40
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL TRAINING/ CAMPS	160
		TOTAL	**720**

M.Sc.-MLT (Pathology)

Fourth Semester University Examination

COURSE CODE	TYPE	COURSE TITLE	Teaching Hours
M01P1001T	CORE	COAGULATION STUDIES	80
M01P1002T	CORE	BLOOD TRANSFUSION	80
M01P1003P	PRACTICAL	COAGULATION STUDIES	80
M01P1004P	PRACTICAL	BLOOD TRANSFUSION	80
M01P1005R	DISSERTATION	DISSERTATION	120
		TEACHING SKILLS/SEMINARS/SYMPOSIA/ JOURNAL CLUB ETC.	40
		CLINICAL LAB PRACTICES OR CLINICAL TRAINING	160
		TOTAL	**640**

Syllabus

M.Sc.-MLT –Semester-I for all Specialization

MEDICAL BIOCHEMISTRY

Course Code: M010701T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To provide brief knowledge of biochemical metabolites.
- To impart knowledge about methods of qualitative and quantitative analysis of biomolecules.

THEORY

1. Carbohydrates

- Definition, Function, Classification, Isomerism & Properties of Monosaccharides, Disaccharides Polysaccharides
- Metabolism-Utilization of Glucose, Glycogenesis (in brief), Glycogenolysis (in brief), Glycolysis, Citric Acid Cycle, Gluconeogenesis(in brief), HMP Shunt(in brief), Regulation of Blood Glucose level

2.-Amino Acids

- Definition, Classification & functions
- Properties

3.- Proteins-

- Definition, classification, functions
- Structural Organization-Primary, Secondary, Tertiary & Quaternary
- Metabolism- Catabolism of Amino Acid Nitrogen, Synthesis of Urea- Transamination, Oxidative deamination, Ammonia formation & Transport, Urea Cycle, Metabolic Disorders in Urea Cycle,
- Essential and non-essential amino acids
- Creatine & Creatinine, Proteinuria

4.-Lipids

- Definition, classification, biomedical importance, Lipoproteins in the blood composition & their functions in brief,
- Metabolism- Beta oxidation of fatty acids, fatty liver, Ketosis, Cholesterol & it's clinical significance. Atherosclerosis. essential fatty acids

5.- Enzymes

- Introduction, definition, classification, coenzymes, isoenzymes, properties, factors affecting enzyme action, enzyme inhibition, diagnostic value of serum enzymes,

6- Hyperglycemia & hypoglycemia –

Hyperglycemia, Diabetes mellitus - definition, types, features, gestation diabetes mellitus, glucose tolerance test, Glycosylated hemoglobin, glycosurias,

- Glucose Tolerance test, Insulin Tolerance Test

Hypoglycemia & its causes

7- Bilirubin General types and Jaundice

- Liver Function Test
  - i) Bilirubin estimation
  - ii) Alkaline phosphates and acid phosphates estimation
  - iii) SGOT, SGPT Estimation

8- Xylose absorption test

9- **Analysis of calculi**

11-Cerebrospinal fluid analysis

- Composition and function of CSF
- Clinical significance of CSF analysis
- Estimation of sugar and proteins in CSF

10- Urine chemistry

- Physical and Chemical examination of Urine samples. Qualitative tests for inorganic urinary ingredients
- Common qualitative and quantitative tests of urine
- Automation in Urine chemistry

11- Renal Function tests-

Functions of Kidney
GFR
Various Renal Function tests

12- Blood gases and pH, carboxyhemoglobin, CO, Met Hb, O_2 saturation

13- Blood collection procedures- theory of anticoagulation.

14- Bio-Medical waste: Types, potential risks and their safe management.

M.Sc.-MLT –Semester-I for all Specialization

CLINICAL PATHOLOGY & IMMUNOPATHOLOGY

Course Code: M010702T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To provide complete knowledge of collection, transportation and processing of various clinical pathology specimens.
- To provide complete knowledge of investigative & diagnostic procedure involved in clinical pathology.
- To provide brief knowledge of immunohematological diseases.

THEORY

A. CLINICAL PATHOLOGY

1. Collection, transport, preservation and processing of various clinical specimens
2. Urine examination- microscopic.
3. Test for haemosiderin pigment.
4. Stool examination
    - Collection of specimen of feaces
    - Macroscopic (Naked eye) inspection
    - Concentration method, Flotation method.
    - Microscopic examination
    - Chemical examination
    - Strip method
    - Test for Occult blood – Benzidine Test

6. Sputum examination –
    - collection of specimen
    - Physical examination
    - Microscopic – Gram's stain, Ziehl Neelsen stain for AFB
    - Chemical examination

7. Gastric analysis

    Indications, contra indications. Method of collection. Fasting gastric juice – Macroscopic and microscopic examination.
    - Fractional test meal
    - Augmented Histamine test
    - Hollander's test

8. Cerebrospinal fluid analysis

    Method of obtaining CSF, indications, contra indications.

    Examination of CSF:
    - Physical examination
    - Biochemical examination
    - Microscopic examination
        a. Cytological examination
        b. Bacteriological examination

9- Semen Analysis- Gross & Microscopic

9. Body fluids

    Microscopic examination of Pleural, Pericardial, synovial, ascitic and peritonial fluid.

10. Pregnancy Test- Method, interpretation.

B. IMMUNOPATHOLOGY

1. Mechanism of Ab-mediated inactivation: direct and indirect

   e.g. Diabetes mellitus, Thyroid diseases, Pernicious anemia, Polyendocrinopathy, Infertility, Haemophilia, Myasthenia gravis, Anti-idiotypes and diseases.

2. Immune deficiency disorders
3. Immunohaematologic diseases: Transfusion reactions, erythroblastosis foetails, warm-antibody disesases, cold antibody diseases, drug and hemolytic diseases, agranulocytosis, thrombocytopenic purpura, immune suppression cytotoxic antibodies in vitro.
4. Immune complex reactions: arthus reaction, serum sickness, evaluation of circulating immune complexes.
5. Connective tissue diseases: Arteritis, SLE, Dermatomyosis, Rheumatic fever, Rhematoid arthritis, Progressive systemic sclerosis.
6. Atopic anaphyllactic reactions: reaginic antibody, anaphylaxis, atopic allery – factors involved, asthma, hay fever, food allergy, insect allergy, atopic eczma, delayed hypersensitivity reactions, contact dematitis, viral infections, graft rejection.
7. Autoallergic diseases: encephalomyelitis, multiple sclerosis, orchitis, thyroiditis, sjogren's syndrome.
8. Granulomatous reactions: Infectious diseases like Tuberculosis, Leprosy.
9. Immunomodulators
10. Autoimmune diseases
11. Immunology of AIDS.

M.Sc.-MLT –Semester-I for all Specialization

GENERAL MICROBIOLOGY
Course Code: M010703T
Theory- Min. Hrs -:80 Hrs.

Objectives

- To provide supportive clinical care and uses of relative investigations.
- To identify the indictors of basic procedures and perform them in appropriate manner.

THEORY

(A) General Microbiology

- Classification of microorganism –Prokaryotes and Eukaryotes
- Microscope – Light/Dark field microscope/ phase contrast /fluorescence/Electron
- Staining Methods: Sample, Stain, Negative staining, Gram's Stain, principle, Modification of Gram's Staining. Acid fast stain, Modifications, Interpretation, About Stain.
- Morphology of Bacteria – Shape, Cell wall, Gram positive cell wall, Gram negative cell wall, Cell membrane. Cytoplasm, Cell wall, Appendages – Capsule, Flagella, Fimbriae/pilli.
- Bacterial spore
- Bacterial growth and nutrition- Growth requirement, sources, environmental factors affecting growth.
- Bacterial count
- Bacterial growth curve, Lag phage, log phase, stationary factors, affecting growth of bacteria – oxygen carbon dioxide, temperature, pH, Light, Osmotic effect.

(B) Sterilization and disinfection: Physical agents – drying heat, dry heat, flaming, incineration, moist heat, filtration, radiation, ionizing radiation, non-ionizing radiation.
Chemical agents of sterilization – Alcohol, Aldehydes. Phenols, halogens, Iodine, Chlorine, Oxidizing, agents, heavy metals, surface active agents. Cationic, Anionic. Dyes – Aniline, Phenol, Coefficient (Rideal Walker Test).

(C) Culture media and Methods

Constituents of culture media, meat extract, yeast extract. Agar types of culture Media-Liquids Semi solid, solid, Peptone water, nutrient, broth, nutrient, Agar basal media, Enriched media, Blood Agar, Chocolate Agar Loffler's serum slop, Blood Culture Media.
Enrichment broth selective media, transport media, differential media, Mackonkey Agar, CLED Agar, Anaerobic culture method.
Culture Method : Streak culture, Lawn or carpet culture, Stroke culture, Stab culture, liquid culture, pour plate culture.
Anaerobic culture methods : Anoxomat, McIntosh & fild's Anaerobic Jar, Gaspak system

D) General Principles in Microbiology

1. Collection and handling of various samples.
2. Antimicrobial sensitivity and assay.
3. Lab animals handling and care
4. Laboratory Safety

M.Sc.-MLT –Semester-I for all Specialization

RESEARCH METHODOLOGY

Course Code: M010704T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- Understand the basic principles of research and methods applied to draw inferences from the research findings.
- To be made aware of the need of biostatistics and understanding of data and sampling methods in pathology lab.

THEORY

Research Methodology

1. Research in Medical Laboratory Technology

- Introduction
- Research for Laboratory Technician: Why? How? And When?
- Research – Definition, concept, purpose, approaches
- Internet sites for Physiotherapist

2. Research Fundamentals

- Define measurement
- Measurement framework
- Scales of measurement
- Pilot Study
- Types of variables
- Reliability & Validity
- Drawing Tables, graphs, master chart etc

3. Writing a Research Proposal, Critiquing a research article

- Defining a problem
- Review of Literature
- Formulating a question, Operational Definition
- Inclusion & Exclusion criteria
- Forming groups
- Data collection & analysis
- Results, Interpretation, conclusion, discussion
- Informed Consent
- Limitations

4. Research Design

- Principle of Designing
- Design, instrumentation & analysis for qualitative research
- Design, instrumentation & analysis for quantitative research
- Design, instrumentation & analysis for quasi-experimental research
- Design models utilized in Physiotherapy

5. Research Ethics

- Importance of Ethics in Research
- Main ethical issues in human subjects' research
- Main ethical principles that govern research with human subjects
- Components of an ethically valid informed consent for research

M.Sc.-MLT –Semester-I for all Specialization

MEDICAL BIOCHEMISTRY

Course Code: M010705P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To provide brief knowledge of biochemical metabolites.
- To impart knowledge about methods of qualitative and quantitative analysis of biomolecules.

PRACTICAL

1- Identification of Carbohydrates (qualitative tests).
3- Identification of Proteins (qualitative tests).
4- To study general properties of the enzyme (Urease) & Achromatic time of Salivary amylase.
5- Urine analysis –abnormal constituents of urine.
6- Biochemical examination of CSF.
7- Estimation of blood sugar by Folin wu method & Glucose Oxidase Method
8- Estimation of blood urea.
9- Estimation of blood uric acid.
10- Estimation of serum creatinine
11- Estimation of total serum protein
12- Estimation of Cholesterol/HDL/LDL Cholesterol by enzymatic method.
13- Estimation of Serum Triglyceride
14- Estimation of Serum Bilirubin- total & direct
15- Estimation of Alkaline & Acid Phosphatase
16- Estimation of SGOT, SGPT, GGTP
17- Estimation of serum – total protein
18- Estimation of serum Globulin
19- Estimation of serum – Albumin
20- Estimation of Serum Amylase
21- Estimation of common parameters in urine through use of strips.

M.Sc.-MLT –Semester-I for all Specialization

CLINICAL PATHOLOGY & IMMUNOPATHOLOGY

Course Code: M010706P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To provide complete knowledge of collection, transportation and processing of various clinical pathology specimens.
- To provide complete knowledge of investigative & diagnostic procedure involved in clinical pathology.
- To provide brief knowledge of immunohematological diseases.

PRACTICAL

A. Clinical Pathology

1. Urine examination - microscopic.
   Urine Test for haemosiderin pigment.
2. Stool examination –
   i. Macroscopic examination
   ii. Concentration method, Flotation method.
   iii. Microscopic examination
   iv. Benzidine Test- for occult blood
3. Sputum examination - Macroscopic, Microscopic and AFB Staining
4. Examination of Cerebrospinal fluid (CSF) and body fluids.
5. Pregnancy Test
6. Examination of Semen-Microscopic.

B. Immunopathology

1. Serological tests (Screening &diagnostic) used in different pathological conditions.
2. Delayed type hypersensitivity testing.
3. Histocompatibility testing
4. Coomb's test – Direct & Indirect
5. Setting up of Immuno histochemistry lab.
6. Other tests

M.Sc.-MLT –Semester-I for all Specialization

GENERAL MICROBIOLOGY
Course Code: M010707P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To provide supportive clinical care and uses of relative investigations.
- To identify the indictors of basic procedures and perform them in appropriate manner.

PRACTICAL

- Culture medias preparation and composition -Nutrient Agar, Mackonkey, Cled, Sabaurauds etc.
- Gram's staining of different specimens like pus, sputum, urine, CSF, endometrial tissue, pleural fluid
- AFB staining of different specimens like sputum, pus, pleural fluid, endometrial tissue.
- Antibiotic sensitivity testing
- Identification of various bacteria on various culture medias.

M.Sc.-MLT –Semester-I for all Specialization

DISSERTATION

Min. Hrs -: 40 Hrs.

- Every candidate pursing M.Sc.-MLT degree course is required to carry out research work on a selected research project under the guidance of a recognized postgraduate teacher. The results of such a work shall be submitted in the form of dissertation. Topic for dissertation shall be assigned by the guide.
- If the subject of thesis requires collaboration with other departments or specialties, the collaborative portion of the work will be supervised by Co-Guide, designated by the School of Health Sciences in consultation with the Guide. Where a Co-Guide is involved, the thesis will be certified jointly by the Guide & Co-guide.
- The students will select various topics concerned with day to day recent trends in medicine and pathological investigations & their various outcomes.
- Before selection of the topic the student must go through various medicinal journals and study them elaborately to understand the recent trends and scientific research.
- A minimum of atleast 5 topics must be scrolled by each students and out of this the most appropriate topic may be selected for his further synopsis preparation with the consent of guide.
- After selection of topic the student has to discuss the various aspects of the selected topic with his guide and strategically plan how he will proceed in his research work.
- Importance should be given to legitimate data collection and handling, sample size and the recent trends in the field of Medical Lab Technology.

M.Sc.-MLT –Semester-II for all Specialization

MEDICAL LABORATORY MANAGEMENT
Course Code: M010801T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To be made aware of basic ethics, good lab practices including awareness/safety in a clinical laboratory.
- To understand sample accountability, quality management system, biomedical waste management.
- To know calibration and validation of clinical laboratory instruments, laboratory information system (LIS), Hospital information system (HIS) and financial management.

THEORY

1. Preparation of operating budgets
General aspects of financial management of laboratories
2. Cost-analysis (tests and instruments); justification of providing new services or rejecting existing ones; lease and purchase decision analysis; delegation of budget responsibilities, work load statistics.
3. Laboratory design
Designing laboratories for different types and sizes of institutions: selection of equipment and systems for the laboratory, concepts of workstation consolidation, workflow analysis, concepts in laboratory automation (sample transportation systems, modular systems, robotics).
4. Laboratory safety
Fire, chemical, radiation and infection control
(Body substance precautions), hazardous waste and transport of hazardous materials.
5. Training of technical staff
Familiarity is needed with the syllabi of various training programs; knowledge of the teaching requirements and level of knowledge technical staff; understanding of qualifications of technologists trained in other countries.
6. Maintenance of records
Procedure manuals, ward manuals, quality control programs, patient data retrieval.
7. Personnel management
Personnel policy manual; job descriptions; labor, supervision relations; conducting job interviews; motivation, recognizing job distress syndrome; delegation to a laboratory manager.
8. Hospital organization
Interactions between the laboratory service and the rest of the hospital.
9. Professional ethics.
10. Quality assurance;
Total quality management; development and monitoring of performance indicators.
11. Public relations:
hospital and community.
12. Basic clinical epidemiology
13. Laboratory Data Processing
14. General principles of methods for reduction of data into forms suitable for electronic data handling systems (computerized accessioning functions, sample identification and tracking (e.g. bar code systems), result reporting, storage and retrieval, electronic data transfer).
15. Use of computers in quality control and management
Use of computers for calculating analytical results (eg. non-linear functions).
16. General aspects of system design
Central vs. stand-alone systems, host computers and equipment interfaces.
17. Laboratory information systems (LIS), Hospital information systems (HIS).
18. Personal computer use
Word processing, spreadsheets, data-base, graphics, statistics, presentations, email, internet. Security of data storage and transmission.
19. Data base structures and data mining.
20. Appropriate access control to patient information.

M.Sc.-MLT –Semester-II for all Specialization

BLOOD GROUPING & IMMUNOLOGY
Course Code: M010802T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- This syllabus provide knowledge about Blood grouping and cross matching.
- Students will be able to perform blood group testing and cross matching.
- To make aware of basic aspects of immunity, antigens, antibodies.
- To make use of immunological diagnosis in patient disease finding.

THEORY

BLOOD GROUPING

Introduction, Human Blood Group system, ABO Subgroups, Red Cell Antigen, Natural Antibodies, Rh System, Rh Antigens & Rh Antibodies, Hemolytic Disease of Newborn & Prevention, Principal of Blood grouping, antigen-antibody reaction, Agglutination, Haemagglutination, Condition required for antigen antibody reaction, Blood grouping techniques, Cell grouping, Serum grouping, Methods for ABO grouping. Slide & Tube Method, Cell grouping, Serum grouping, Rh grouping by slide & tube method, Difficulties in ABO grouping, Rouleaux formation, how it interferes with Blood grouping, Auto agglutinins, Antiserum used in ABO test procedures, Anti –A, Anti-B Anti- AB Antiserum, Inheritance of the Blood groups, Control, A&B Cells preparation, Auto control, Medical applications of Blood groups.

CROSS MATCHING

Purpose
Major and Minor cross matching
Different types of Major & Minor tests
Difficulties in cross matching

Immunity-Innate Immunity, Acquired Immunity and Miscellaneous Immunity-Concepts of specificity and memory, Basic properties of innate immune cells, Basic properties of adaptive immune cells.

Physiochemical properties of innate immunity-Physiological barriers, Anatomical barriers, Phagocytic/endocytic barriers, Inflammatory barriers, Immune Response -Humoral & Cell mediated.

Antigens and Immunogens - Complete antigens, Heptane, Factors affecting antigens, Classes of antigens, Immunoglobulins (Igs), Types of Immunoglobulins, Properties of Immunoglobulins, Abnormal Immunoglobulins, Monoclonal antibodies

Antigen/Antibody reactions-Precipitation, Agglutination, Compliment fixation test, Neutralization test, Immunofluorescence, Radioimmuno assay, ELISA, Rapid tests, Chemiluminisence linked Immunoassay, Immuno electron microscopy, Immunoblotting, Applications of antigens/antibody reactions.

Compliment system pathway

Immunological mechanism in health system - Lymphoid system, MHC Complex

M.Sc.-MLT –Semester-II for all Specialization

BIOMEDICAL TECHNIQUES
Course Code: M010803T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To make aware of different biomedical techniques and their uses.

THEORY

1. Methods of qualitative analysis of biomolecules:
   Principles, experimental procedures and application of chromatography – paper, thin-layer, ion exchange, affinity, gel filtration, gas-liquid and HPLC. Principles, procedures and application of Electrophoresis – paper, polyacrylamide gel, agarose gel, capillary and cellulose acetate.

2. Quantitative methods:
   Principles and applications of Photometry, Spectrophotometry, flurometry, ion selective procedures, flame photometry, atomic absorption spectrometry. Ion selective electrodes and their applications in Medicine.

3. Centrifugation Techniques –
   Principle and technique of preparative and analytical centrifugation, differential centrifugation, density gradient centrifugation, ultra-centrifuge and its application.

4. Radio Isotopes:
   Detection and measurement of radioactive isotopes, application of isotopes in research and clinical bio-cemsitry, Radioactive emissions, radiation-matter interaction, radiation dose.

5. Cell Fractionation, Biochemical activities of different fractions, marker enzymes.

6. Bioenergetics and Biological oxidation:
   Concept of free energy change, high energy compounds, ATP generation, redox Potential Assessment, Electron transport chain, oxidative phosphorylation, inhibitors, Uncouplers, ionophores.

7. Purification of enzymes from cells, characterization and Internal Assessment of purity, purification of proteins.

M.Sc.-MLT –Semester-II for all Specialization

BIOSTATISTICS
Course Code: M010804T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To know the basic knowledge of Biostatistics and their use in data analysis.
- To evaluate patient data

THEORY

1. Biostatistics
- Introduction
- Definition
- Types
- Application in Physiotherapy

2. Data
- Definition
- Types
- Presentation
- Collection methods

3. Measures of central value
- Arithmetic mean, median, mode. Relationship between them
- Partitioned values- Quatertiles, Deciles, Percentiles
- Graphical determination

4. Measures of Dispersion
- Range
- Mean Deviation
- Standard Deviation

5. Normal Distribution Curve
- Properties of normal distribution
- Standard normal distribution
- Transformation of normal random variables.
- Inverse transformation
- Normal approximation of Bioaxial distribution.

6. Correlation analysis
- Bivariate distribution:
- Scatter Diagram
- Coefficient of correlation
- Calculation & interpretation of correlational coefficient
- T-test, Z-test, P-value

7. Regression analysis
- Lines of regression
- Calculation of Regression coefficient
- Sampling distribution
- Standard error
- Types I & II error

9. Probability (in Brief)

10. Hypothesis Testing
- Null Hypothesis
- Alternative hypothesis
- Acceptance & rejection of null Hypothesis
- Level of significance

11. Parametric & non parametric tests
- Chi square test
- Mann-Whitney U test
- Wilcoxon Signed test
- Kruskal-Wallis test
- Friednam test
- T-test/student T test
- Analysis of variance

M.Sc.-MLT –Semester-II for all Specialization

MEDICAL LABORATORY MANAGEMENT
Course Code: M010805P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To be made aware of basic ethics, good lab practices including awareness/safety in a clinical laboratory.
- To understand sample accountability, quality management system, biomedical waste management.
- To know calibration and validation of clinical laboratory instruments, laboratory information system (LIS), Hospital information system (HIS) and financial management.

PRACTICAL

- Sample accountability-
    - Labeling of sample
    - Making entries in Laboratory records
- Reporting results-
    - Basic format of a test report
    - Release of examination results
    - Alteration in reports
- Calibration and Validation of Clinical Laboratory instruments
- Ethics in medical laboratory practice in relation to the following:
    - Pre-Examination procedures
    - Examination procedures
        - -Reporting of results
    - Preserving medical records
- Access to medical laboratory records 8. Audit in a Medical Laboratory – Documentation

M.Sc.-MLT –Semester-II for all Specialization

BLOOD GROUPING & IMMUNOLOGY
Course Code: M010806P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- This syllabus provide knowledge about Blood grouping and cross matching.
- Students will be able to perform blood group testing and cross matching.
- To make aware of basic aspects of immunity, antigens, antibodies.
- To make use of immunological diagnosis in patient disease finding.

PRACTICAL

1. Blood grouping.
2. Rh grouping & Rh typing (slide & tube method)
    - Du Testing
    - Rh – antibody titration
3. Compatibility Testing
    - Selection of blood
    - Crossmatching Technique – Major, Minor, Saline, Albumin, Coomb's, Emergency and Special conditions.
4. Rapid plasma Reagin Tests
5. Rheumatoid arthritis factors
6. C reactive protein test
7. ELISA
8. Antistreptolysin-O

M.Sc.-MLT –Semester-II for all Specialization

BIOMEDICAL TECHNIQUES
Course Code: M010807P
Practical- 80 Hrs.

Objectives

- To make aware of different biomedical techniques and their uses.

PRACTICAL

1. Chromatography: paper, thin layer, gel, ion-exchange, demonstration of HPLC and GLC
2. Photometry, spectrophotometry, atomic absorption spectrophotometry
3. Electrophoresis: slide gel, PAGE, Agarose gel, Native, SDS PAGE of Blood Sample. (Demo only)
4. Cell fractionation – methods
5. Estimation of Inorganic phosphorous
6. Estimation of Serum Calcium
7. Estimation of LDH
8. Estimation of CK Nac
9. Estimation of CK MB
10. Estimation of Sodium
11. Estimation of Potassium
12. Estimation of Phosphorus
13. Estimation of TIBC
14. Estimation of Hemoglobin
15. Other tests

M.Sc.-MLT –Semester-II for all Specialization

DISSERTATION
Course Code: M010808R
Min. Hrs -: 120 Hrs.

- Every candidate shall submit synopsis to the University in the prescribed Performa containing particulars of proposed dissertation work, within 6 months from the date of commencement of the course on or before the dates notified by the university.
- The synopsis shall be sent through the proper channel. Such synopsis will be reviewed and the university will register the dissertation topic.

Students will prepare their synopsis for dissertation in consultation with their guides.

Performa for synopsis:

1. Introduction
2. Aims and Objectives
3. Review of Literature
4. Methodology or Material and Methods
5. References

Note:

1. The copies of synopsis must be in bound properly.
2. The candidate have to submit 4 copies of synopsis.
3. Colour scheme for synopsis will be white.
4. Text writing
   Paper to be used – A4 size (Bond Paper)
   Printing – One side
   Font - Title – 18 Pt. Bold
   Heading – 16 Pt. Bold.
   Sub Heading – 14 Pt. Bold
   Running text (English) -12 Pt. – Times New Roman
   Running Text (Hindi) 14 Pt. (CG12, Krutidev 10)
   Spacing : Double
   Margin : Left – 4 Cm, Top, Bottom, Right – 2.5 Cm.
   Page Numbering– Properly numbered

5. Writing Reference

Should be numbered consecutively in the order in which they are first mentioned in the text (not in alphabetic order). Identify references in text, tables and legends by Arabic numerals in superscript. References cited only in tables or figure legends should be numbered in accordance with the sequence established by the first identification in the text of the particular table or figure.

Journal Articles
Shashi A, Jain SK and Pandey M: *In-vitro* evaluation of antilthiatic activity of seeds of *Dolichos biflorus* and roots of *Asparagus racemosus* . International Journal of Plant Sciences 2008; 1:67-71.

A Book
Kalia AN: A Text Book of Industrial Pharmacognosy. CBS Publishers & Distributors, First Edition 2005.

A Chapter in a Book
Nadkarni KM: Indian Materia Medica. Popular Prakashan, Mumbai, Edition 3, Vol. I, 2000: 242-246.

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

CLINICAL BIOCHEMISTRY
Course Code: M01C0901T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- The students will get knowledge about Vitamins, minerals and various investigations.

THEORY

1. Glycated Hemoglobin
   -Introduction, Importance
   Test for HBA1c Estimation

2-Clinical features and laboratory findings in disorders of the plasma proteins; acute phase proteins. Causes of hypoalbuminemia; hypo- and hyperglobulinemias.

3. Lipid profile, Separation of lipoproteins

4. NUCLEIC ACIDS
   - Nucleotides and their bases, DNA, RNA, High energy compounds.
   - Major roles of purines and pyrimidines, synthesis of pyrimidines, pyrimidine salvage, catabolism of pyrimidines, synthesis of purines, purine salvage, catabolism of purines, Gout.

5. VITAMINS
   - Fat- & water-soluble vitamins, sources, requirement, deficiency disorders & biochemical functions.

6. ENERGY METABOLISM AND NUTRITION
   - Food calories, RQ, BMR, RDA, SDA, calorie requirements, proteins in nutrition, fats in nutrition, carbohydrates in nutrition, fibers in nutrition, protein –energy malnutrition, starvation, diet for normal adults, pregnant women, children, etc.

7. MINERAL METABOLISM AND ITS DISORDERS.
   - Macronutrients (Principal mineral elements), Micronutrients-Sodium and potassium, chlorine, calcium and phosphorus, magnesium, sulfur metabolism, Iron, copper, Zinc, Manganese, Molybdenum, Cobalt, Selenium, Iodine, Fluorine, chromium, Water Balance.

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

ENDOCRINOLOGY
Course Code: M01C0902T
Theory- Min. Hrs.: 80 Hrs.

Objectives

- To correlate hormones with clinical disorders.
- To provide complete information regarding diagnostics procedures related to hormone testing.

THEORY

ENDOCRINOLOGY

1. Introduction
2. Difference between hormones and enzymes.
3. Classification of hormones.
4. Neurotransmitter families
5. Hormones receptors
6. Regular and general mechanism of hormone, Signal transductions.
7. Regulation and general mechanism of action of hormones.
8. Pituitary gland & hypothalamus and its hormones.
9. Hormones of the Anterior Pituitary- Growth hormone, Prolactin, Gonadotropin, Follicle Stimulating hormone, Luteinizing Hormone, Thyroid stimulating hormone (TSH), Adrenocorticotropic hormone (ACTH)
10. Hormones of posterior pituitary (neurohypophysis)- Oxytocin, Antidiuretic hormone (ADH)
11. Hormones of the Thyroid gland- chemistry and normal physiology, Thyroid disorders-goiter, myxedema, autoimmune thyroiditis, tumors of the thyroid gland, hyperthyroidism, Graves disease, Calcitonin, Parathyroid Hormone (PTH)
12. Adrenocortical hormones-synthesis and secretion, Aldosterone & its function, Addison's disease, Glucocorticoids & functions, Mineralocorticoids & functions, Cortisol & functions, Cushing's syndrome, Conn's syndrome.
13. Adrenal medulla-metabolism of catecholamines
14. Hormones of the gonads -
    Testosterone, Estrogens, Progesterone, their synthesis and functions.
    Human Chorionic Gonadotropin (HCG), hormone, menstrual cycle, Menopause
15. Gastrointestinal hormones.
16. Hormone of pancreas - Insulin- its metabolic effects on carbohydrates, fats & protein, control of insulin secretion, Insulin like growth factor, Glucagon- functions, metabolic effects, blood glucose regulation, Diabetes Mellitus, Somatostatin.
17. Hormone of kidney - Renin

ASSESSMENT OF THYROID FUNCTION

- The structure, biosynthesis, secretion, and metabolism of thyroid hormones (thyroxine (T_4), triiodothyronine(T_3), and reverse T_3 (rT3). Thyroid physiology and control of thyroid function (thyrotropin-releasing hormone (TRH) and thyrotropin (TSH).
- The common causes of hypothyroidism and hyperthyroidism
- The laboratory tests for evaluation of thyroid disorders and be able to interpret these analytes in their clinical context with an appreciation for the euthyroid sick state.
- Current analytical methodologies for thyroid testing (TSH methods : 1st-, 2nd-, and 3rd-generation assays; isotopic and non-isotopic methods; T4; free T_3 methods; T-uptake methods; TSH suppression and stimulation tests).

M.Sc.-MLT – (Clinical Biochemistry)

Semester-III

TUMOR & CANCER MARKERS
Course Code: M01C0903T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To provide knowledge about Tumor & cancer markers.

THEORY

1. Introduction
2. The Carcinogens-definition.
3. Oncogene-definition-
   Mechanism of action of Oncogenes (outline).
4. Characteristics of growing tumor cells-general and morphological changes, biochemical changes.
5. Tumor Markers-
   Definition, Classification, Biochemistry and distribution of tumor markers both protein and carbohydrate.
6. Clinical applications of tumor markers.
7. Enzymes as tumor markers, Alkaline Phosphatase (ALP), Creatine kinase (CK), Lactate dehydrogenase (LDH), Prostatic acid phosphatase (PAP), Prostate specific antigens (PSA).
8. Hormones as tumor markers (introduction of each type).
9. Oncofetal antigens.
10. Alpha feto protein (AFP)
11. Carcino embryonic antigen (CEA)
12. Squamous cell carcinoma (SCC) antigen.
13. Carbohydrate markers (introduction of each type)
    CA 15-3, CA 125
14. Blood group antigen (introduction of each type)
    CA 19-9, CA 50, CA 72-4, CA 242
15. Bladder cancer markers (introduction) -
    Bladder tumor antigen (BTA)
16. Fibrin- Fibrinogen degradation product (FDP).
17. Nuclear matrix protein (NMP22).
18. Biomarkers still in research (introduction)-
    Telomeres, TRAP assay, hyaluronic acid and Hyaluronidase
19. Limitations of laboratory assessment various tumor markers and the factors affecting the results of different analytical procedure.
20. The conceptual basis of assays used to screen for malignancy include Bayes theorem.
21. Recent developments in identifying proteomic patterns for cancer detection.
22. Free radicals and Antioxidants

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

CLINICAL BIOCHEMISTRY
Course Code: M01C0904P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- The students will get knowledge about Vitamins, minerals and various investigations.

PRACTICAL

- Estimation of blood urea.
- Estimation of blood uric acid.
- Estimation of serum creatinine.
- Estimation of total serum protein.
- Estimation of Inorganic phosphorous.
- Estimation of Cholesterol/HDL/LDL Cholesterol.
- Estimation of Serum Triglyceride
- Estimation of Serum Calcium
- Other tests

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

ENDOCRINOLOGY
Course Code: M01C0905P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To correlate hormones with clinical disorders.
- To provide complete information regarding diagnostics procedures related to hormone testing.

PRACTICAL

- Estimation of T3
- Estimation of T4
- Estimation of TSH
- Estimation of FSH
- Estimation of LH
- Estimation of hCG
- Estimation of Cortisol
- Estimation of Progesterone
- Estimation of Testosterone
- Other tests

M.Sc.-MLT – (Clinical Biochemistry)

Semester-III

TUMOR & CANCER MARKERS
Course Code: M01C0906P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To provide knowledge about Tumor & cancer markers.

PRACTICAL

- Estimation of Alpha feto proteins (AFP)
- Estimation of Carcino embryonic antigen (CEA)
- Estimation of CA- 125
- Estimation of Prostate specific antigen (PSA)
- Estimation of CA-153
- Other tests

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

DISSERTATION

Min. Hrs -: 40 Hrs.

- Students will continue research work as per the synopsis.
- Data should be collected as per the ethical norms and the sample size.
- Day to day discussions and presentation of the collected data before the guide needs to be done periodically.
- After discussion the concerned changes may be made in the research work to improve its quality.
- Care should be taken to avoid plagiarism and the research work should be genuine.

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

TEACHING SKILLS/SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.
Min. Hrs -: 40 Hrs.

(a) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(b) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(c) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(d) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the candidate by the student.

M.Sc.-MLT (CLINICAL BIOCHEMISTRY)

Semester-III

CLINICAL TRAINING/CAMPS

Min. Hrs -: 160 Hrs.

The students will get their clinical training in a Medical College OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory.

They will participate in various medical camps.

M.Sc.-MLT – (Clinical Biochemistry)
Semester-IV

APPLIED BIOCHEMISTRY
Course Code: M01C1001T
Theory- Min. Hrs -: 80 Hrs.

Objective

- To provide brief knowledge about applied clinical biochemistry.

THEORY

1- **Inborn errors of Metabolism**
Hereditary anemia, carbohydrate metabolism, lipid metabolism, protein metabolism, nucleic acid metabolism

2- **Detoxification**
Oxidation, Reduction, Hydrolysis, Conjugation

3- **Toxicants in food**
Naturally occurring toxicants, Fungal Contamination, Toxic effects of some metals and chemicals

4- **Cardiac Profile**
Major manifestation of heart disease, Ischemic Heart disease, Angina pectoris, Myocardial Infarction, Hypertension,

5- **The chemistry of respiration-**
Diffusion of gases in lungs, Transport of oxygen by the blood, Factors affecting dissociation of oxyhemoglobin, cacarboxy hemoglobin, the transport of CO2 in the blood, buffer systems of the blood, chloride shift, Acid-base balance, Hypoxia

6- **Recombinant DNA Technology**
Introduction, Biological Importance, Restriction enzymes, DNA Cloning, Polymerase chain reaction, Prenatal Diagnosis, Practical application of Recombinant DNA Technology, Its use in molecular analysis of disease. Restriction fragment Length Polymorphism(RFLP), Gene therapy, Glossary, Clinical aspects

7- **Biochemical & Genetic Basis of disease**
Introduction, Biochemical standpoint, The major classes of genetic diseases, Pathologic consequences of genetic diseases, Gene therapy

8- **The Human Genome project**
Principal methods adopted to identify & isolate normal and disease genes, Major finding reported in the rough drafts of the human genome, Major classes of proteins encoded by human genes, Implications for proteomics, biotechnology and bioinformatics, Implications for medicine

M.Sc.-MLT – (Clinical Biochemistry)

Semester-IV

AUTOMATION
Course Code: M01C1002T
Theory- Min. Hrs -: 80 Hrs.

Objective

- To provide comprehensive knowledge of the automation in the laboratory.

THEORY

1. Automation - Introduction, meaning, advantages, history
2. Continuous flow analyzers
3. Single channel continuous flow analyzers-advantages, disadvantages
4. Multi-channel flow analyzers
5. Discrete auto analyzers - basic features, types, semi-automated, fully automated
6. Batch analyzers
7. Random access analyzers (RAA)
8. Component steps in fully automated analyzers
9. Auto analyzers based on immunoassay techniques, Micro particle enzyme immunoassay (MEIA)
10. Various random-access analyzers - Hitachi- 704, BM/Hitachi - 717
11. Centrifugal analyzers, ASCA
12. Dry chemistry analyzers
13. Dimension RxL clinical chemistry system
14. The Heterogeneous Immunoassay module components
15. Beckman Array 360 system
16. Mini Vidas analyzers
17. Immulite automated immunoassay analyzers
18. Latest trends in Automation, Biochips, Lab on a chip (LoC), Nano sensors- advantages and disadvantages, PCR & its applications.

M.Sc.-MLT – (Clinical Biochemistry)

Semester-IV

APPLIED BIOCHEMISTRY
Course Code: M01C1003P
Practical- Min. Hrs -: 80 Hrs.

Objective

- To provide brief knowledge about applied clinical biochemistry.

PRACTICAL

- Estimation of blood sugar
- Estimation of HbA1c
- Estimation of blood urea.
- Estimation of blood uric acid.
- Estimation of serum creatinine.
- Estimation of Blood Urea Nitrogen
- Estimation of Serum Bilirubin- total & direct
- Estimation of total serum protein.
- Estimation of serum – Albumin
- Estimation of serum – Globulin
- Estimation of Inorganic phosphorous.
- Estimation of Cholesterol/HDL/LDL Cholesterol.
- Estimation of Serum Triglyceride
- Estimation of Serum Calcium
- Estimation of Alkaline & Acid Phosphatase
- Estimation of SGOT, SGPT, GGTP
- Estimation of Serum Amylase
- Estimation of LDH
- Estimation of CK Nac
- Estimation of CK MB
- Estimation of Sodium
- Estimation of Potassium
- Estimation of Phosphorus
- Estimation of Iron Profile
- Estimation of Hemoglobin
- Estimation of Hexagon Troponin +
- Estimation of Magnesium
- Estimation of Vitamin D
- Estimation of B12
- Other tests

M.Sc.-MLT – (Clinical Biochemistry)

Semester-IV

AUTOMATION
Course Code: M01C1004P
Practical- Min. Hrs -: 80 Hrs.

Objective

- To provide comprehensive knowledge of the automation in the laboratory.

PRACTICAL

DIFFERENT TEST

1. Test for HIV
2. Test for Hepatitis B (HBsAg)
3. Test for Hepatitis (HCV)
4. Malaria antigen

All Clinical Biochemistry Practicals/Analysis done on fully Automated Analyzer, Minividas and ELISA Reader etc.

M.Sc.-MLT – (Clinical Biochemistry)
Semester-IV

DISSERTATION
Course Code: M01C1005R
Min. hours- 120 hrs.

- No change in the dissertation topic or guide shall be made without prior approval of the institute.
- Guide will be only a facilitator, advisor of the concept and hold responsible in correctly directing the candidate in the methodology and not responsible for the outcome and results.
- The dissertation should be written under the following headings.
    1. Introduction
    2. Aims or objectives of study
    3. Review of literature
    4. Material and methods
    5. Results
    6. Discussion
    7. Conclusion
    8. References
    9. Master and Chart & Table (If Applicable)
    10. Annexure (If Applicable)

The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 120 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of bond paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for having done the work himself should also be included, and the guide, head of the department and Director/Coordinator of the institute shall certify the dissertation/ research project.

Every candidate is required to give power point presentation before final submission of dissertation. Four copies of Dissertation/research project shall be submitted to the university, through proper channel, along with a soft copy (CD), 2 months before the final examination. It shall be assessed by two examiners appointed by the university, one internal and one external. There will be a power point open presentation of the submitted dissertation as per the schedule given by the university. This presentation shall be jointly evaluated by external and internal examiner as per the criteria given below: Objective(s) of the work done, Methodology adopted, Result and Discussion, Conclusion & outcome.

If the student failed to secure the minimum passing marks he will resubmit the dissertation 01 month before the supplementary exam.




M.Sc.-MLT, Semester-IV

TEACHING SKILLS/SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.
Min. Hrs -: 80 Hrs.

(a) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(b) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(c) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(d) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the candidate by the student.

M.Sc.-MLT, Semester-IV

CLINICAL LAB PRACTICES OR CLINICAL TRAINING

Min. Hrs -: 160 Hrs.

Clinical Lab Practices

Post graduate students must do:

- Sample collection, storages & analysis of every sample given to them for various parameters.
- They should know proper laboratory management.
- They should work on every instrument according to their specialization.
- Maintenance and care of the instrument of the laboratory.
- They will do hospital/laboratory/blood bank postings for training & skill development.

OR

Clinical Training

The students will get their clinical training in a medical college OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory for at least one month.

REFERENCE BOOKS:

1. Strayer H. Gerjmetal-W.H. Freeman and company New York.
2. Lehninger's Principles of Biochemistry – Lehnineger. A.L., Nelson. D.L., Eral-C.B.S. Publishers and distributors, New Delhi.
3. Harper Illustrated Biochemistry – Murray R.K. Grannar, D.K. Mayes-P.A. Eral, McGrawHill.
4. Medical Biochemistry – N.V. Bhagavan -Academic Press.
5. Text Book of Biochemistry – A.S. Saini, C.B.S Publishers and distributors.
6. Teitz fundamentals of Clinical Chemistry – Burtis. C.A. Ashoowd E. R. – Har Court (India) Ltd.
7. Varley's Practical Clinical Biochemistry – Gowenlock and Bell William Heinemann.
8. Text Book of Biochemistry with Clinical Correlations – Devlin T.M. Wiley Liss, New York.
9. Clinical Physiology of Acid-Base balance and Electrolyte disorders – Rose. B.D – Mcgraw-Hill International edition New York.
10. Methods in Bio-Statistics for Medical students – Mahajan. B.K. Jaypee brothers Medical Publishers, New Delhi.
11. Manual of Practical Biochemistry for M.B.B.S –S.K. Gupta, Veena Singh Ghalaut- Arya publishing Company, New Delhi.
12. Clinical Chemistry – Theory analysis and Correlation – Kalpan. L.A. and pesse. A.G- C.V. Moslay and Company St. Louis, M.O.
13. Principles of Biochemistry – CBS Publishers – Lehninger, Nelson, Cox.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

SYSTEMIC BACTERIOLOGY
Course Code: M01M0901T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To understand different types of bacterial culture procedure.
- To understand the staining procedure and various test to identify the bacteria.
- To understand the morphology, cultural characteristics and lab diagnosis of various bacteria.

THEORY

Gram-positive cocci :- Staphylococcus, Streptococcus, Pneumococcus,
Gram-negative cocci:- Neisseria Gonorrhea and Neisseria Meningitidis
Gram-positive bacilli:- Cornybacterium diphtheria, Clostridium Tetanae Clostridium Bottalenum, Mycobacterium tuberculosis, Mycobacterium Leprae, Bacillus
Gram-negative bacilli:- Enterobacteriaceae- E.coli, Klebsiella, Proteus, Salmonella, Helicobacter. Pylori, Shigella
Miscellaneous Bacteria:- Spirocheates, Mycoplasma, Chlamydia

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

VIROLOGY
Course Code: M01M0902T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To understand the basics of various viruses.
- Various diseases caused by viruses, general characteristics and lab diagnosis of various medically important viruses.
- To understand the introduction general characteristics and lab diagnosis of various medically important viruses.

THEORY

- **Parvoviruses** : Morphology, Classification, Pathogenesis, Clinical Manifestations, Erythema infectiosum, Lab Diagnosis, Molecular Method, Antibody Detection.
- **Adenoviruses** - Morphology, Classification, Pathogenesis, Clinical Manifestations, Respiratory Diseases, Pneumonia, Occular infections, Infantile gastroenteritis, Lab Diagnosis, Specimen collection, Virus isolation, General preventive measures
- **Herpes viruses –** General properties, morphology, classification, herpes simplex virus, pathogenesis, primary infection, latent infection, recurrent infection, clinical manifestations, oral facial, nervous, cutaneous, ocular, genital, visceral, neonatal herpes, lab diagnosis, cytopathology, virus isolation, antibody detection.
- **Pox viruses**- Morphology, classification, small pox, differences between small pox and chicken pox, molluscum contagiosum virus-*clinical manifestation, transmission, lab diagnosis*.
- **Orthomyxo viruses** – Influenza viruses- Morphology, Antigenic variation, Antigenic shift and antigenic drift, pathogenesis, Transmission-target cell entry, spread, local damage, clinical manifestations, incubation period, flu syndrome- complications, lab diagnosis, specimens, collection, isolation of viruses, detection of virus, direct immunofluorescence test, molecular method, antibody detection.
- **Mumps viruses-**Pathogenesis, clinical manifestations, incubation period in apparent infection, bilateral parotitis, aseptic meningitis, oophoritis, lab diagnosis, specimens, direct viral antigen, detection, viral isolation, serum antibody detection
- **Measles viruses** – Pathogenesis, clinical manifestations, incubation period, prodromal stage, eruptive, post measles, complications, secondary bacterial infections, central nervous system complications, lab diagnosis, specimens, antigen detection, virus isolation, antibody detection, reverse transcriptase, PCR.
- **Picorna viruses**- Classification, Morphology, enteroviruses, Polio virus, antigenic types, pathogenesis, transmission, clinical manifestations, risk factors, lab diagnosis, virus isolation, antibody detection, vaccines, injectiable polio vaccine, IPV salk vaccine, advantages, disadvantages, oral polio vaccine (OPV), sabin vaccine, advantages, disadvantages.
- **Miscellaneous RNA viruses –** Corona viruses- morphology, classification, human corona viruses, transmission, lab diagnosis, antigen detection, RNA detection, isolation, serum antibody detection, treatment & prevention.
- **Hepatitis viruses-** Hepatitis A, B, C, D & E- morphology, resistance, mode of transmission, clinical manifestations, lab diagnosis.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

MYCOLOGY
Course Code: M01M0903T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To understand the basics of various fungi.
- Various diseases caused by fungi
- To understand the introduction, general characteristics and lab diagnosis of various medically important fungi.

THEORY

- **Study of Fungi**

  Classification, morphological classification, yeast, yeast like fungus, molds, dimorphic fungi, classification of fungal diseases, superficial mycosis, subcutaneous mycosis, systemic mycosis, opportunistic mycosis

- **Lab diagnosis of fungal diseases**

  Specimen collection, microscopy, KOH preparation, gram stain, India ink stain, calcofluor, white stain, histopathological stain- PAS, GMS, mucicarmine, lactophenol cotton blue, culture, culture media, sabouraud's dextrose agar, Corn meal agar and rice starch agar, brain heart infusion agar.

- **Superficial mycosis**

  Tinea versicolor, clinical manifestation, lab diagnosis, direct microscopy culture, tinea nigra, piedra-black piedra & white piedra.

- **Dermatophytosis, Tinea Ring Worm**

  Pathogenesis, clinical types, lab diagnosis, specimen collection, direct examination, culture, macroscopic and microscopic.

- **Subcutaneous mycosis**

  Mycetoma – Types of mycetoma, pathogenesis, clinical manifestations, lab diagnosis, specimen collection, direct examination, culture.

  Sporotricosis – pathogenesis, clinical manifestations, lab diagnosis, direct microscopy, histopathological staining, culture,

  Rhinosoporidiosis – Agent, source, distribution and diagnosis.

- **Systemic Mycosis**

  Histoplasmosis–Causative agent, pathognenesis, clinical manifestations, pulmonary, mucocutaneous, disseminated, lab diagnosis, specimen, direct microscopy, culture, serology.

  Blastomycosis- Pathogensis, clinical manifestations, lab diagnosis.

  Coccidioido mycosis – Pathogenesis, clinical manifestations, lab diagnosis.

- **Opportunistic mycosis**

  Candidiasis- Pathogenesis, predisposing factor, clinical manifestation, mucosal, cutaneous, invasive, allergic, lab diagnosis-direct microscopy, culture.

  Cryptococosis- Pathogenesis, virulence factors, risk factors, clinical manifestations, pulmonary, meningitis, lab diagnosis – direct detection methods, negative staining & Gram staining, culture.

  Mucormycosis-Pathogenesis, predisposing factors, clinical manifestations, lab diagnosis, staining, culture, microscopic appearance.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

SYSTEMIC BACTERIOLOGY
Course Code: M01M0904P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To understand different types of bacterial culture procedure.
- To understand the staining procedure and various test to identify the bacteria.
- To understand the morphology, cultural characteristics and lab diagnosis of various bacteria.

PRACTICAL

Isolation, characterization, and identification of pathogens from various clinical specimens.

1. Study of morphology, culture, and biochemical characteristics of common bacterial pathogens
2. Study of antibiotic sensitivity of common pathogens.
3. Leprae bacilli staining, modified AFB staining
4. Staining for mycobacterium tuberculosis, AFB staining
5. Antibiotic sensitivity testing
6. Sputum culture, Urine culture,
7. Pus culture
8. Colony characteristics of various bacteria on various media
9. Smear preparation from various clinical specimen and staining

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

VIROLOGY
Course Code: M01M0905P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To understand the basics of various viruses.
- Various diseases caused by viruses, general characteristics and lab diagnosis of various medically important viruses.
- To understand the introduction general characteristics and lab diagnosis of various medically important viruses.

PRACTICAL

- ELISA tests
- Lab diagnosis of viral infections
- Cultivation of viruses

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

MYCOLOGY
Course Code: M01M0906P
Practical- Min. Hrs -:80 Hrs.

Objectives

- To understand the basics of various fungi.
- Various diseases caused by fungi
- To understand the introduction, general characteristics and lab diagnosis of various medically important fungi.

PRACTICAL

- Lab diagnosis of fungal infections.
- Various medias used for fungus.
- Identification of fungus from various specimens.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

DISSERTATION

Min. Hrs -: 40 Hrs.

- Students will continue research work as per the synopsis.
- Data should be collected as per the ethical norms and the sample size.
- Day to day discussions and presentation of the collected data before the guide needs to be done periodically.
- After discussion the concerned changes may be made in the research work to improve its quality.
- Care should be taken to avoid plagiarism and the research work should be genuine.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

TEACHING SKILLS/SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.

Min. Hrs -: 40 Hrs.

(e) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(f) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(g) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(h) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the candidate by the student.

M.Sc.-MLT (Medical Microbiology & Immunology)

Semester-III

CLINICAL TRAINING/CAMPS

Min. Hrs -: 160 Hrs.

The students will get their clinical training in a medical college OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory.

They will participate in various medical camps.

M.Sc.-MLT (Medical Microbiology & Immunology)
Semester-IV

APPLIED MICROBIOLOGY & IMMUNOLOGY
Course Code: M01M1001T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To understand the various aspects of microbiology in causation of diseases.
- To understand the various hospital acquired infections.
- To understand the prevention of various diseases.

THEORY

APPLIED MICROBIOLOGY

- **Urinary Tract Infections-** Classification, epidemiology, Predisposing factors, prevalence, gender, age, pregnancy, vesico ureteric reflux, genetic factor, causative agents, pathogenesis, ascending root infection, descending root infection, host defence mechanism, clinical manifestation, asymptomatic bacteuria, lower UTI, upper UTI, cystitis, acute urethral syndrome, pyelonephritis, lab diagnosis, specimen collection, transport, culture and direct examination.
- **Diarrheal diseases-** Diarrhea, gastroentitis, dysentery, food poisoning, travelers diarrhea, etiological agents, pathogenesis, toxin production, host factors, lab diagnosis by specimen collection, microscopy, wet mount, hanging drop, grams staining, AFB staining, electro microscopy, bacterial culture, tissue culture, antigen detection, molecular method, toxin detection.
- **Meningitis -**Definition, types of meningitis, causative agents, pathogenesis, roots of infections, hematogenous, direct defect in CNS, predisposing factors, vaccination age, presence of CSF shunts, clinical manifestations, lab diagnosis, specimen collection, CSF collection, CSF transport, biochemical analysis and cell count of CSF, Bacterial meningitis, tubercular meningitis, viral meningitis, CSF microscopy, gram's staining, ZN staining, India ink, antigen detection from CSF, bacteriological culture, antibody detection.
- **Fever of unknown origin –** Definition, causes, lab diagnosis, specimen collection, microscopy, culture, serological method, molecular tests.
- **Respiratory tract infection-** upper respiratory tract infection, lower respiratory tract infection, pneumonia, clinical symptoms- Lobar pneumonia, atypical pneumonia, bronchitis, bronchiolitis, lab diagnosis, specimen collection, culture, identification & serology.
- **Hospital acquired infections –** Definition, factors, immune status, hospital environment, hospital organisms, transfusion, sources of infection, endogenous source, exogenous source, microorganisms for hospital acquired infections, mode of transmission, types of hospital acquired infections, prevention of hospital acquired infections, standards precautions, specific precautions, air born droplet contacts precautions, hand hygiene, hand rub and hand wash, methods.

IMMUNOLOGY

- **Antigen** – Types, epitopes, factors affecting antigenicity, clinical significance, biological classes and super antigens.
- **Immunoglobulin** – Properties, abnormal immunoglobulins, immunoglobulin classes, IgG, IgA, IgM, IgD, IgE,
- **Hypersensitivity reaction** (Type 1, Type 2, Type 3, Type 4) Anaphylactic, Cytotoxic, Immune complex mediated, Delayed or cell- mediated.
- **Antigen antibody reaction**:- Precipitation, Agglutination, Complement fixation, Neutralization, Immunoflurosence, Radioimmunoassay, ELISA
- **Auto Immune Diseases.**

M.Sc.-MLT (Medical Microbiology & Immunology)
Semester-IV

PARASITOLOGY
Course Code: M01M1002T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To provide brief knowledge of parasites involved in human infections.
- To understand the life cycle and lab diagnosis of various medically important human parasites.
- To understand the general characteristics of medically important parasites.

THEORY

Study of morphology, important developmental stages, symptoms, pathogenesis & diagnosis of

- Entamoeba histolytica
- Entamoeba coli
- Giardia
- Trichomonas
- Balantidium coli
- Malarial parasites
- Plasmodium
- Taenia sollium
- Taenia saginatta
- Schistostoma Haemotobium
- Fasciola hepatica
- Ascaris
- Enterobius
- Ancylostoma,
- Wuchereria bancrofti

M.Sc.-MLT (Medical Microbiology & Immunology)
Semester-IV

APPLIED MICROBIOLOGY & IMMUNOLOGY
Course Code: M01M1003P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To understand the various aspects of microbiology in causation of diseases.
- To understand the various hospital acquired infections.
- To understand the prevention of various diseases.

PRACTICAL

1. Antistreptolysin -O test
2. VDRL Testing
3. CRP Testing
4. Enzyme linked immunosorbent assay.

M.Sc.-MLT (Medical Microbiology & Immunology)
Semester-IV

PARASITOLOGY
Course Code: M01M1004P
Practical- Min. Hrs -: 80 Hrs.

Objectives

- To provide brief knowledge of parasites involved in human infections.
- To understand the life cycle and lab diagnosis of various medically important human parasites.
- To understand the general characteristics of medically important parasites.

PRACTICAL

- Diagnostic tests for detection of parasitic infections- methods for demonstration of parasites in clinical specimens
- Identification of different Ova and Cysts in stool.
- Stool examination

M.Sc.-MLT –(Medical Microbiology & Immunology)

Semester-IV

DISSERTATION
Course Code: M01M1005R
Min. hours- 120 hrs.

- No change in the dissertation topic or guide shall be made without prior approval of the institute.
- Guide will be only a facilitator, advisor of the concept and hold responsible in correctly directing the candidate in the methodology and not responsible for the outcome and results.
- The dissertation should be written under the following headings.
    1. Introduction
    2. Aims or objectives of study
    3. Review of literature
    4. Material and methods
    5. Results
    6. Discussion
    7. Conclusion
    8. References
    9. Master and Chart & Table (If Applicable)
    10. Annexure (If Applicable)

The written text of dissertation/ research project shall not be less than 50 pages and shall not exceed 120 pages excluding references, tables, questionnaires and other annexure. It should be neatly typed in double line spacing on one side of bond paper (A4 size, 8.27" x 11.69") and bound properly. Spiral binding should be avoided. A declaration by the candidate for having done the work himself should also be included, and the guide, head of the department and Director/Coordinator of the institute shall certify the dissertation/ research project.

Every candidate is required to give power point presentation before final submission of dissertation. Four copies of Dissertation/research project shall be submitted to the university, through proper channel, along with a soft copy (CD), 2 months before the final examination. It shall be assessed by two examiners appointed by the university, one internal and one external. There will be a power point open presentation of the submitted dissertation as per the schedule given by the university. This presentation shall be jointly evaluated by external and internal examiner as per the criteria given below: Objective(s) of the work done, Methodology adopted, Result and Discussion, Conclusion & outcome.

If the student failed to secure the minimum passing marks he will resubmit the dissertation 01 month before the supplementary exam.

M.Sc.-MLT, Semester-IV

TEACHING SKILLS/SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.
Min. Hrs -: 40 Hrs.

(e) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(f) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(g) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(h) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the candidate by the student.

M.Sc.-MLT, Semester-IV

CLINICAL LAB PRACTICES OR CLINICAL TRAINING

Min. Hrs -: 160 Hrs.

Clinical Lab Practices

Post graduate students must do:

- Sample collection, storages & analysis of every sample given to them for various parameters.
- They should know proper laboratory management.
- They should work on every instrument according to their specialization.
- Maintenance and care of the instrument of the laboratory.
- They will do hospital/laboratory/blood bank postings for training & skill development.

OR

Clinical Training

The students will get their clinical training in a medical college OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory for at least one month.

REFERENCE BOOKS:

1. Text book of Microbiology by Ananthnarayan, Orient Longman.
2. Diagnostic Microbiology by Bailey & Scott, Mosby.
   Medical Microbiology by Greenwood & Slack; Churchill Livinstone.
3. The Short Textbook of Medical Microbiology by Satish Gupte; Jaypee.
4. Text book of Medical Parasitology by Panikar; Jaypee.
5. Colour Atlas and Textbook of Diagnostic Microbiology by Koneman, Williams Wilkins.
6. District Laboratory in Tropical Countries , Monica Cheesbrough, Cambridge.
7. Mackie & Maccarteney Practical Medical Microbiology; Churchill Livingstone.
8. Essential Immunology, Roitts & Delves 10th Edition; Blackwel Science.

M.Sc.-MLT –(Pathology)

Semester-III

HISTOPATHOLOGY
Course Code: M01P0901T
Theory- Min. Hrs -: 80 Hrs.

Objectives

- To provide knowledge of histopathology and exfoliative cytology.
- To provide knowledge of procedures of tissue processing – fixing, microtomy, staining & mounting.
- To provide knowledge of museum techniques – fixing of specimen, storage and mounting of specimens.

THEORY

1. Introduction to Histopathology, exfoliative Cytology.
2. Basic steps for Tissue Processing- Fixing, Embedding, Microtomy, Staining, Mounting, methods of decalcifications, assessment of decalcification, solution for decalcification.
3. Laboratory requirements for Histopathology & Cytology - Chemicals & Reagents
4. Equipments - Microscope, Microtome -Types, Uses, Parts, different types of microtome knives, care & maintenance. Automated tissue processor - components, working & precautions during use, Tissue floating bath.
5. Staining Methods -
   a. Hematoxylin & Eosin stain, Hematoxylin - Types, methods of preparation, staining, Eosin - Method of preparation.
   b. Reticulin stain
   c. PAP staining- components & methods.
6. Museum Techniques
   a. The mounting of pathological specimens - Introduction., Preparation of specimen, Fixation of specimen- Kaiserling solution-1 & Kaiserling solution-2
   b. Precaution taken for the Fixation of Specimens.
   c. Storage of Specimens.
   d. Mounting of Museum Specimens.
   e. Routine Mounting of Specimens.
   f. Filling and Scaling.

M.Sc.-MLT –Pathology

Semester-III

HAEMATOLOGY

Course Code: M01P0902T
Theory- Min. Hrs -: 80 Hrs.

Objective

- To provide knowledge of Hematology and hematological disorders.

THEORY

1. General aspects:
   Blood cell formation, Sites of hemopoiesis. Development of blood cells. Morphology and Regulation of hemopoiesis.
2. Red cells
   Basic aspects of anaemia, definition, patho physiology, classification and clinical features. Investigation of a case of anaemia in general.
3. Microcytic hypochromic anaemias
   Sideroblastic anemia
   Anaemia of chronic infection
   Thalassaemia.
   Iron deiciency anaemia – Iron metabolism, causes of iron deficiency, clinical features, laboratory investigations.
4. Macrocytic Anaemias
   Megaloblastic
   Non megaloblastic
   Megaloblastic anaemia – Etiology, clinical features, laboratory investigation. Pernicious anaemia.
5. Normocytic normochronic anaemia
   Anaemia in systemic disorders
   Acute blood loss, Renal failure
   Liver disorders etc.
6. Disorders of Haemoglobin
   Structure of Hb and Synthesis
   Normal and Abnormal haemoglobins
   Hemoglobinopathies
7. Haemolytic anaemia
   Definition, pathogenesis, classification, clinical features, Extrinsic factors & Intrinsic factors - investigation
   Laboratory investigations to establish a case of haemolytic anaemia.
   I. Peripheral smear – specific morphologic abnormalities
   II. Special tests
      a) Osmotic fragility test
      b) Sickling test

   a) Kleihauer acid elution test
      b) Alkali denaturation test
      c) Ham's test,
      d) Sucrose lysis test
      e) Coomb's test
      f) Electrophoresis – HbF, HbA_2 estimation
      g) Tests for G6PD deficiency

   III. Hemolytic disease of new born – causes and investigations
8. Aplastic anaemia
   Pancytopenia.
9. Polycythemia
   Classification Clinical features, laboratory investigation

10. Leucocyte disorders
    Leukemoid reaction – type of leukemoid and diagnosis.
    Myelodysplastic syndrome [MDS] Definition, clinical features, peripheral smear and Bone marrow findings.
    Leukaemias: Definition, –French- American-British [FAB] and World Health Organization- classification of acute leukaemias
    Diagnostic criteria , Cytochemical staining and Immunophenotyping
    Chronic Leukaemias: classification, Diagnostic criteria .
11. Myeloproliferative disorders –
    Classification, Clinical features, laboratory investigations.
    Chronic myeloid leukaemia in detail.
12. Lymphoproliferative disorders-
    Chronic lymphocytic leukaemia in detail.
13. Plasma cell disorders – classification.
    Plasma cell myeloma – definition. Clinical features, laboratory investigations.
14. B.M. Examination- Aspiration and Trephine biopsy staining
15. Molecular genetics in hematology

M.Sc.-MLT –(Pathology)

Semester-III

BLOOD BANK PROCEDURES
Course Code:: M01P0903T
Theory- Min. Hrs -: 80 Hrs.

Objective

- To provide basic knowledge of blood donation and other procedures at blood bank.

.

THEORY

1. BLOOD DONATION

- Introduction
- Blood donor requirements
- Criteria for selection & rejection
- Medical history & personal details
- Self-exclusion.
- Health checks before donating blood.
- Screening for TTI.

2. BLOOD COLLECTION

- Blood collection packs.
- Anticoagulants.
- Taking & giving sets in Blood transfusion.
- Techniques of collecting blood from a donor.
- Instructions given to the donor after blood donation.
- Adverse donor reaction.

3. TESTING DONOR BLOOD

- Screening donor's blood for infectious agents - HIV, HCV, HBV, Trepanoma palladium, Plasmodium, HTLV.
- Bacterially contaminated Blood.

4. BLOOD DONOR RECORDS

- Blood donation record book., Recording results, Blood donor card.

5. STORAGE & TRANSPORT

- Storage of blood, Changes in blood after storage, Gas refrigerator,
- Lay out of a blood bank refrigerator
- Transportation.

6. MAINTENANCE OF BLOOD BANK RECORDS

- Blood bank temperature sheet.
- Blood bank stock sheet.
- Blood transfusion request form.

7. COMPATIBILITY TESTING

- Labeling & Issuing cross- matched blood.

8. BLOOD COMPONENTS

- Collection of blood components for fractional transfusion.
- Platelets packed Red Cell, Platelet rich Plasma, Platelets concentrate.
- Preparation of concentrated (packed) Red cells.
- Techniques of preparation.

9. HAEMAPHERESIS

- Definition
- Types of pheresis
- Machines and Techniques.

10. Tissue banking
11. Cord blood banking
12. Stem cell processing, storage and transplantation
13. Disposal of wastes and biologically hazardous substance in the blood bank
14. Technical advances and future trends in blood banking

15. Quality Assurance

- General condition, Equipment, Reagents, Donor processing

16. Drugs control regulation and Blood Bank

M.Sc.-MLT –(Pathology)

Semester-III

HISTOPATHOLOGY
Course Code: M01P0904P
Practical- Min. Hrs -: 80 Hrs.,

Objectives

- To provide knowledge of histopathology and exfoliative cytology.
- To provide knowledge of procedures of tissue processing – fixing, microtomy, staining & mounting.
- To provide knowledge of museum techniques – fixing of specimen, storage and mounting of specimens.

PRACTICAL

1. Microtome, instrument, principle, use in section cutting, parts and working of commonly used microtome, different kinds of microtome, rotary, base sledge, sliding, low temperature microtome, cryostat, microtome knives, homing and stropping knives.
2. Fixation of tissue, different kind of fixatives, sample fixative, compound fixative, formaldehyde, mercuric chloride, osmium, Picric acid, alcohols, other acids, formalin, buffered formalin, osmic acid, zenleer solutionn, helly's solution, cytological fixatives, nuclear fixatives, fixation of smear etc., decalcification, method of decalcification, assessment of decalcification, solution for decalcification.
3. Processing of tissue, dehydration, impregnation in the wax, manual and automatic tissue processor, gelatin embedding, celloidin embedding, double embedding, cytological fixatives, preparation of different smears, vaginal, sputum, membrane.
4. Section cutting of paraffin sections, section preparation from frozen sections, fixing of tissue to slide, preparation of celloidin section and fixation. Staining techniques, natural dyes, synthetic dyes, basic and acidic dyes, haematoxylin staining, Pap, flicker & Conn, methanamine silver nitrate, ziehl neelsen's stain, propylene glycol sudan technique, papanicolaou, harn's alum, Haematoxylin, acridine orange technique.
5. H&E Staining
6. PAP Staining

M.Sc.-MLT –Pathology

Semester-III

HAEMATOLOGY

Course Code: M01P0905P
Practical- Min. Hrs -: 80 Hrs.

Objective

- To provide knowledge of Hematology and hematological disorders.

PRACTICAL

1. Blood collection. Anticoagulants used in Hematology
2. Preparation of Stains, Reagents, Diluting fluids.
3. Red cell indices
4. E.S.R., PCV, Platelet count, Absolute Eosinophil count
5. Reticulocyte count
6. Stains used in Hematology
   i. Preparation of blood film
   ii. Preparation of Leishman's stain, Giemsa stain and MGG stain
7. Peripheral smear staining by Leishman's stain. Interpretation of peripheral smear. Differential count.
8. Microcytic hypochromic anemia –
   Investigations including serum Iron & TIBC
9. Macrocytic anemia- Investigations including B_{12} & folate assay, schilling test
10. Hemolytic anemia- General Lab investigations
12. Hemolytic anemia- Special Tests.
    i. Osmotic fragility test
    ii. Alkali denaturation test
    iii. Sickling test
    iv. Hb electrophoresis
    v. Investigations of G6PD deficiency
    vi. Autoimmune hemolytic anemia investigations
    vii. Coomb's test
13. Blood Parasites
14. Bone marrow – preparation of bone marrow smears, Trephine biopsy smears
    Staining of B.M Aspiration Smears. Demonstration of Iron stain
15. Leukemia - Interpretation of Peripheral smear in Leukemia.
    Cytochemical stains – Demonstration

M.Sc.-MLT –(Pathology)

Semester-III

BLOOD BANK PROCEDURES
Course Code: M01P0906P
Practical- Min. Hrs -: 80 Hrs.

Objective

- To provide basic knowledge of blood donation and other procedures at blood bank.

.

PRACTICAL

1. Blood Collection
   - Donor selection
   - Blood collection [Phlebotomy]
   - Post donation Care
2. Preservation and Storage of blood
3. Preparation and Storage of blood Components
   - Packed Cells, Fresh Frozen plasma [FFP], Platelet Concentrate, Cryoprecipitate
   - Component transfusion – selection of blood group

4. Quality control – Methods
   - Reagents
   - Test methods
   - Products
   - Documents
   - Equipment
5. Apheresis procedures- Types of pheresis, Machines and Techniques.
6. Orientation of a blood bank
7. Blood Bank Administration
   - Record keeping
   - Computerization in blood transfusion services

M.Sc.-MLT –(Pathology)

Semester-III

DISSERTATION

Min. Hrs -: 40 Hrs.

- Students will continue research work as per the synopsis.
- Data should be collected as per the ethical norms and the sample size.
- Day to day discussions and presentation of the collected data before the guide needs to be done periodically.
- After discussion the concerned changes may be made in the research work to improve its quality.
- Care should be taken to avoid plagiarism and the research work should be genuine.

M.Sc.-MLT –(Pathology)

Semester-III

TEACHING SKILLS/SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.
Min. Hrs -: 40 Hrs.

(i) Teaching Skills

Candidates should be encouraged to teach undergraduate students if any. This performance will be based on assessment by the faculty members of the department and from feedback from the undergraduate students.

(j) Seminar

- Seminars /recent advance presentation will be held every week, however, its timings are subject to clinical schedule. Topics must be well researched and must include common knowledge, recent advances, analysis and references.
- PG students should present minimum of two seminars (One in general and one in elective area) and Internal Assessment marks will depend on better topic selection and presentation.

(k) Journal Review Meeting (Journal Club):

The ability to do literature search, in depth study, presentation skills, and use of audio- visual aids are to be assessed. The assessment is made by faculty members and peers attending the meeting.

(l) Work diary / Log Book

Every student shall maintain a work diary and record his/her participation in the training programmes conducted by the department such as journal reviews, seminars, etc. Special mention may be made of the presentations by the candidate as well as details of clinical practice, if any conducted by the candidate by the student.

M.Sc.-MLT –(Pathology)

Semester-III

CLINICAL TRAINING/CAMPS

Min. Hrs -: 160 Hrs.

The students will get their clinical training in a medical college OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory.

They will participate in various medical camps.

M.Sc.-MLT –(Pathology)

Semester-IV

COAGULATION STUDIES
Course Code: M01P1001T
Theory- Min. Hrs -: 80 Hrs.

Objectives:

- To provide brief introduction of coagulation system and factors involved in coagulation.
- To provide knowledge about diagnosis of coagulation factors deficiencies.

THEORY

1. Hemostasis - Definition, Basic concept and principle, Basic steps involved in Hemostasis.
2. Coagulation -
   a. Basic Physiology, coagulation factors.
   b. Mechanism of blood coagulation.
   c. Extrinsic Pathway.
   d. Intrinsic Pathway.
   e. Regulators of blood coagulation.
3. Testing of blood coagulation -
   a. Bleeding Time, Duke's method.
   b. Clotting Time- Capillary tube method & Lee white's method.
   c. PT, aPTT, TT
   d. Clot retraction time
   e. Determination of fibrinogen.
   f. Coagulation factor assay

   Factor VIII: C Inhibitor study
   Urea Solubility test for factor XIII

4. Quality Assurance for routine Hemostasis Laboratory-
   a. Introduction.
   b. Sample collection technique (Phlebotomy)
   c. Sample preparation, Anticoagulant used, Importance of use of Sodium Citrate.
5. Role in Diseases, Bleeding disorders-
   a. Platelet disorder - Thrombocytopenias - causes including aplastic anemia.
   b. D I C
   c. IT P
   d. Hemophilia
6. Thrombotic disorders –
   Classification, Pathogenesis, Clinical Features and Laboratory Investigations. Antiphospholipid, Antibody Syndrome.

M.Sc.-MLT (Pathology)
Semester-IV

BLOOD TRANSFUSION
Course Code: M01P1002T
Theory- Min. Hrs -: 80 Hrs.

Objective

- To provide brief knowledge (both theory and practical) about blood transfusion reactions and quality assurance.

THEORY

BLOOD TRANSFUSION

- History of transfusion
- Principal & indications for blood Transfusion.
- Blood Transfusion service at District level.
- Guide lines for the use of Blood, Appropriate use of Blood, Quality Assurance.
- Antilogous Blood Transfusion practices.
- Objectives of Quality Assurance in Blood Transfusion services, Standard operating procedures for usage, donation & storage of blood,

BLOOD TRANSFUSION REACTIONS

- Investigation of a Transfusion reaction.
- Hemolytic transfusion reaction.
- Actions to take when transfusion reaction occurs.

TRANSFUSION TRANSMITTED INFECTIONS-

HIV, Hepatitis B, HCV etc.

MEDICO LEGAL ASPECTS OF BLOOD TRANSFUSION

ADVANCEMENT IN BLOOD TRANSFUSION

PATERNITY TESTING

M.Sc.-MLT (Pathology)
Semester-IV

COAGULATION STUDIES
Course Code: M01P1003P
Practical- Min. Hrs -: 80 Hrs.

Objectives:

- To provide brief introduction of coagulation system and factors involved in coagulation**.**
- To provide knowledge about diagnosis of coagulation factors deficiencies**.**

PRACTICAL

1. Precautions to prevent hemolysis
2. Storage of blood specimens
3. Bleeding time & clotting time estimation
4. Prothrombin time estimation
5. aPTT (activated partial thromboplastin time) estimation.
6. Clot retraction time estimation
7. Test for D-Dimers
8. Assay for coagulation factors
9. Factor VIII: C Inhibitor study- Demonstration
10. Urea Solubility test for factor XIII
11. Investigation for Antiphospholipid Antibody
12. Other tests

M.Sc.-MLT (Pathology)
Semester-IV

BLOOD TRANSFUSION
Course Code: M01P1004P
Practical- Min. Hrs -: 80 Hrs.

Objective

- To provide brief knowledge (both theory and practical) about blood transfusion reactions and quality assurance.

PRACTICAL

1. Crossmatching in special situations
2. Exchange transfusion – selection of blood group
3. Autoimmune haemolytic anaemia
4. Investigation of Blood Transfusion reaction
5. Testing for transfusion Transmitted Diseases
   - Elisa-HIV, HBsAg, HCV
   - VDRL Test
   - Malaria
6. Visit to Blood Bank

M.Sc.-MLT – (Pathology)
Semester-IV

DISSERTATION
Course Code: M01P1005R
Min. hours- 120 hrs.

- No change in the dissertation topic or guide shall be made without prior approval of the institute.
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If the student failed to secure the minimum passing marks he will resubmit the dissertation 01 month before the supplementary exam.

M.Sc.-MLT, Semester-IV

TEACHING SKILLS/ SEMINARS / SYMPOSIA/ JOURNAL CLUB ETC.

Min. Hrs -: 40 Hrs.

(i) Teaching Skills

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M.Sc.-MLT, Semester-IV

CLINICAL LAB PRACTICES OR CLINICAL TRAINING

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OR

Clinical Training

The students will get their clinical training in a medical college OR 100 bedded hospital with well-equipped Pathology/ Clinical Biochemistry/ Medical Microbiology Laboratory for at least one month.

REFERENCE BOOKS:

HEMATOLOGY & CLINICAL PATHOLOGY

1. Clinical Haematology, Illustrted – Colour Atls Victor Hoffbrand, John E Peth't.
2. Practical Haematolgoy –Dacie, Lewis.
3. Haematology – Williams
4. Wintrobe clinical haematology Vol- I.
5. Wintrobe clinical haematology Vol- II.
6. Lynch's Medical Lab – Technology Latest edition
7. Clinical Diagnosis & Management – Todd & Sanford.
8. Medical Laboratory Technology by Sood, Jaypee Brothers.
9. Clinical Haematology in Medical Practice – G.C. Degruchy.

HISTOPATHOLOGY

1. Atlas of Histopathology, J.P.
2. Histopathology, Guy Orchard
3. Histopathology, William Stewart.
4. Histotechnology, Freida L. Carson.
5. Forensic Histopathology, Darin P. Trelka.
6. Diagnostic Criteria Handbook in Histopathology, P.J. Tadrous.

BLOOD TRANSFUSION

1. Technical manual – AABB
2. The Clinical use of Blood Handbook, WHO
3. ABO Rh system – Ortho diagnostics
4. Compatibility testing – Ortho diagnostics
5. Compendium of transfusion medicine, Fr. R. N. Makroo.
7. Blood transfusion in Clinical Medicine – Mollision.
8. Blood group Serology, Theory, Techniques, Practical application – K.E.Boorman , B.E Dodd, P.J. Lincoln.8.Technical Manual, AABB.
9. Rossi's Principles of Transfusion Medicine, Toby L.Simon ,Walter H Dzik,Edward L. Snuder , Christopher P. Stowell Ronald G. Strauss, Lippincott.