



# **SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH**

(A Deemed to be University Declared under Section 3 of UGC Act, 1956)

Comprising Sri Devaraj Urs Medical College

[Constituent Unit of Sri Devaraj Urs Educational Trust for Backward Classes (Regd.)]

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(With effect from 2015-16 batches)

## **Post Graduate Curriculum for Master of Science in Medical Laboratory Technology – Clinical Microbiology and Immunology**

**Dean**

Faculty of Allied Health Sciences  
Sri Devaraj Urs Academy of  
Higher Education & Research  
Tamaka, Kolar-563 101

Approved as per BOM-25-2013, (Resolution No XXV-04(c)/13) Dated-19/06/2013

# REGULATIONS GOVERNING

## MASTER OF SCIENCE

### MEDICAL LABORATORY TECHNOLOGY IN **CLINICAL MICROBIOLOGY & IMMUNOLOGY** UNDER FACULTY OF ALLIED HEALTH SCIENCES

### SYLLABUS/CURRICULUM 2015 - 16



### **SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH**

(A Deemed To be University)

Declared under Section 3 of UGC Act, 1956, MHRD GOI No.F.9-36/2006-U.3(A) dt.25<sup>th</sup> May 2007  
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**SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION & RESEARCH**  
**Comprising Sri Devaraj Urs Medical College**  
**(A-Deemed-To-Be-University)**

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No: SDUAHER/KLR/ADMN/ 4274 / 2014-15

Date: 10.12.2013

**NOTIFICATION**

Sub: Regulations and Curriculum for M.Sc. Medical Laboratory Technology program.

- Ref: 1. Proceedings of the 3rd meeting of Curriculum Development Committee held on 16.03.2013  
2. Proceedings of the 9<sup>th</sup> meeting of BOS Allied Health Sciences Held on 08.04.2013.  
3. Proceedings of 10<sup>th</sup> meeting of BOS Allied Health Sciences Held on 09.10.2013.  
4. Proceedings of the 14<sup>th</sup> meeting of Academic Council held on 20.05.2013.  
5. Proceedings of 25<sup>th</sup> meeting of Board of Management held on 19.06.2013.

Sri Devaraj Urs Academy of Higher Education and Research was declared as Deemed to be University under Section 3 of UGC Act, 1956, MHRD GOI No.F.9-36/2006-U.3(A), Dated 25<sup>th</sup> May 2007. In accordance with the resolutions of the Curriculum Development Committee, Board of Studies of Allied Health Sciences and Academic Council held as above, decided to approve Regulations and Curriculum for the M.Sc. in Medical Laboratory Technology (Clinical Biochemistry, Clinical Microbiology and Immunology and Hematology and Blood Transfusion) programs offered under the Department of Allied Health Sciences.

In exercise of the power conferred on the University under Section 6 of MoA rules as per UGC regulations - 2010, the university is pleased to notify the Regulations and Curriculum for students admitted to M.Sc. MLT program offered under the department of Allied Health Sciences from the academic year 2014-15.

By Order,

**Sd/-**  
**Registrar**

## **SRI DEVARAJ URS ACADEMY OF HIGHER EDUCATION AND RESEARCH**

### **VISION**

**"UNIVERSITY OF EXCELLENCE - KNOWLEDGE FOR POSTERITY"**

### **MISSION**

- To be a global center of excellence for Teaching, Training and Research in the field of Higher Education.
- To inculcate scientific temper, research attitude and social accountability amongst faculty and students.
- To promote with value based education for the overall personality development and leadership qualities to serve the humanity.

### **OBJECTIVES**

- To provide need based infrastructure and facilities to students to become responsible professionals with social commitment and accountability.
- To implement effectively innovative programs in teaching learning and evaluation.
- To impart scientific and socio cultural temperament among students to forge National identity and needs.
- To provide instruction and training in basic and advanced branches of learning.
- To provide facilities for research for the advancement and dissemination of knowledge.
- To undertake extra mural studies, consultancy, extension programs and field outreach services for the development of society.
- To collaborate with other Universities, Institutions of excellence and Research Organizations within the country and outside for the purpose of teaching, training and research.
- To undertake need based activities for the betterment of socially and educationally backward society.

# **MASTER OF SCIENCE (M.Sc.) MEDICAL LABORATORY TECHNOLOGY CLINICAL MICROBIOLOGY & IMMUNOLOGY**

## **GOAL AND PROGRAM OBJECTIVE**

The goal and objective of the M.Sc Medical Laboratory Technology program are to create qualified and competent technical personnel in the field of medical laboratory technologies to support the health care system in the country.

## **STUDENT LEARNING OUTCOMES**

Graduates will have cognitive psychomotor and affective skills required to accomplish the roles and responsibilities of medical Laboratory technologists.

Graduates will have clinical exposure to learn more about laboratory diagnosis and management.

Graduates will have technical skills and shall be able to provide reliable results with assertion and confidence in performing laboratory tasks.

Graduates will have appropriate professional communication skills, attitudes and ethics expected of medical laboratory technologists.

Graduates will integrate the roles and services of laboratory technicians with the roles and services of other health care professionals in patient care.

SL.No.	CONTENTS	Page No
I	<b>Notification, Vision and Mission Goal and program objectives</b>	1-4
II	<b>Regulations Governing M.Sc. MLT course</b>	4-17
III	<b>COURSE CONTENT</b>	
	<b>I Year MSc MLT[1<sup>st</sup> and 2<sup>nd</sup> semesters]</b>	18-52
3.1	<b>Biochemistry - I</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management  <b>Biochemistry - II</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management	18-25
3.2	<b>Microbiology - I</b> <b>Paper title:</b> Clinical Microbiology & Immunology  <b>Microbiology - II</b> <b>Paper title:</b> Clinical Microbiology & Molecular Biology	26-35
3.3	<b>Hematology &amp; Blood Transfusion-I</b> <b>Paper title:</b> Haematology, Clinical Pathology & Immunopathology  <b>Haematology &amp; Blood Transfusion-II</b> <b>Paper title:</b> Haematology, Clinical Pathology & Medical Genetics	36-48
3.4	Subsidiary subjects	49-52
IV	<b>COURSE CONTENT</b>	
	<b>II Year MSc MLT[3<sup>rd</sup> and 4<sup>th</sup> semester]</b>	
4.1	<b>Microbiology</b> <b>Paper -I</b> Systemic Bacteriology& Immunology <b>Paper -II</b> Virology & mycology	53-68
V	<b>Monitoring Learning Progress Ethics in M.Sc. MLT Infrastructure and man power requirement</b>	69-

## **2.0 Regulations Governing M.Sc. Medical Laboratory Technology Clinical Microbiology & Immunology program**

### **1. TITLE OF THE COURSE**

Master of Science degree in Medical Laboratory Technology in Clinical Haematology & Blood Transfusion program abbreviated as M.Sc. MLT- CHBT

### **2. DURATION OF THE COURSE**

The duration of the Master's Degree in Medical Laboratory technology including submission of project work on the topic registered shall be for a period of two years (consists of four semesters ) from the commencement of the academic term.

### **3. ELIGIBILITY FOR ADMISSION**

The students who have passed B.Sc. Medical Laboratory Technology (MLT) Course from Institutions affiliated to RGUHS/other recognised Universities/ considered equivalent by SDUAHER are eligible to this course.

Note: Candidates passing B.Sc. MLT degree through Correspondence shall not be eligible

### **4. SELECTION CRITERIA**

Seat Selection shall be based on the University conducted entrance examination. The merit in the qualifying examination followed interview by the selection committee.

Note: The candidate has to choose the branch of his /her choice during the time of seat selection. No change of branch will be permitted once he /she get admitted.

### **5. ELIGIBILITY CERTIFICATE**

No candidate shall be admitted for the MSc MLT course unless the candidate has obtained and produced the eligibility certificate issued by the university.

The original Marks cards of all the university examinations passed. Migration certificate. Certificate of conduct, Transfer certificate. Proof of SC/ST or category-I as the case may be. A candidate who has been admitted to post-graduate course should register his/her name in the university within a week time after paying the prescribed fee.

Note: Candidates should obtain the eligibility certificate before the last date for admission as notified by The university.

### **6. MEDIUM OF INSTRUCTION**

English shall be the medium of instruction for the subjects of study as well as for the Examination.

## **7. COURSE OF STUDY**

The course shall be pursued on full time basis. There are three branches in M.Sc MLT course. However, both study and examination of main and subsidiary subjects in first year (first and second semester) shall be common to all the three branches/specialities.

In the second year (third and fourth semester) the student shall study subject of his/ her chosen branch during admission.

Note: Students shall be posted to clinical/department/clinical laboratories as per the university direction.

## **8. ATTENDANCE**

Every candidate should have attended at least 75% of the total number of classes conducted in a semester from the date of commencement of the semester to the last working day as notified by university in each of the subjects prescribed for that year, separately, in theory and practical. Only such candidates are eligible to appear for the University examinations in their first attempt.

A candidate lacking the prescribed percentage of attendance in any subject either in Theory or Practical in the first appearance will not be eligible to appear for the University Examination in that particular subject. The course shall be pursued on full time basis.

Note: No candidate shall join any other course of study or appear for any other examination conducted by this university or any other university in India or abroad during the period of study.

**First year (1<sup>st</sup> and 2<sup>nd</sup> semester) subjects for study, teaching hours, and distribution of marks. Second year (3<sup>rd</sup> and 4<sup>th</sup> semester) of M.Sc. MLT program are shown in following Tables.**

**Table - I Distribution of Teaching Hours in First Year [1<sup>st</sup> semester] M.Sc. MLT**

SL. No.	Mani Subjects	Theory Hours	Practical hours	Total
1	<b>Biochemistry - I</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management	50	50	100
	<b>Section A:</b> Clinical Biochemistry	25	50	
	<b>Section B:</b> Biomedical Techniques and Laboratory Management	25		
2	<b>Microbiology - I</b> <b>Paper title:</b> Clinical Microbiology & Immunology	50	50	100
	<b>Section A :</b> Clinical Microbiology	25	50	
	<b>Section B :</b> Immunology	25		
3	<b>Hematology &amp; Blood Transfusion-I</b> <b>Paper title:</b> Hematology, Clinical Pathology & Immunopathology	50	50	100
	<b>Section A :</b> Hematology	25	50	
	<b>Section B :</b> Clinical Pathology and Immunopathology	25		
	<b>Subsidiary subject:</b>			
	a. Research methodology	20		20
		170	150	320

Note: Main and Subsidiary subjects are common in I year for all the three branches

**Table - I (a) Distribution of Teaching Hours in First Year [2nd semester] M.Sc. MLT**

SL. No.	Mani Subjects	Theory Hours	Practical hours	Total
1	<b>Biochemistry - I</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management	50	50	100
	<b>Section A:</b> Clinical Biochemistry	25	50	
	<b>Section B:</b> Biomedical Techniques and Laboratory Management	25		
2	<b>Microbiology - II</b> <b>Paper title:</b> Clinical Microbiology & Molecular Biology	50	50	100
	<b>Section A :</b> Clinical Microbiology	25	50	
	<b>Section B :</b> Molecular Biology	25		
3	<b>Hematology &amp; Blood Transfusion-II</b> <b>Paper title:</b> Hematology, Clinical Pathology & Medical Genetics	50	50	100
	<b>Section A :</b> Hematology	25	50	
	<b>Section B :</b> Clinical Pathology & Medical Genetics	25		
	<b>Subsidiary subject:</b>			
	a. Biostatics	20		20
		170	150	320

Note: Main and Subsidiary subjects are common in I year for all the three branches.

**Table- I (b) Distribution of marks for First semester M.Sc. MLT**

Paper	Subject	Theory marks			Practical marks				Grand total
		Theory	IA	Sub total	Practical	IA	Viva voce	Sub total	
	<b>FIRST SEMESTER</b>								
I	<b>Biochemistry - I</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management	100	20	120	40	10	30	80	200
	<b>Section A:</b> Clinical Biochemistry	50							
	<b>Section B:</b> Biomedical Techniques and Laboratory Management	50							
II	<b>Microbiology - I</b> <b>Paper title:</b> Clinical Microbiology & Immunology	100	20	120	40	10	30	80	200
	<b>Section A :</b> Clinical Microbiology	50							
	<b>Section B :</b> Immunology	50							
III	<b>Hematology &amp; Blood Transfusion-I</b> <b>Paper title:</b> Hematology, Clinical Pathology & Immunopathology	100	20	120	40	10	30	80	200
	<b>Section A :</b> Hematology	50							
	<b>Section B:</b> Clinical Pathology and Immunopathology	50							
	<b>Grand Total</b>	300	60		120	30	90		600

**Table- I (c) Distribution of marks for second semester M.Sc. MLT**

Paper	Subject	Theory marks			Practical marks				Grand total
		Theory	IA	Sub total	Practical	IA	Viva voce	Sub total	
	<b>SECOND SEMESTER</b>								
I	<b>Biochemistry - II</b> <b>Paper title:</b> Clinical Biochemistry, Biomedical Techniques and Laboratory Management	100	20	120	40	10	30	80	200
	<b>Section A:</b> Clinical Biochemistry	50							
	<b>Section B:</b> Biomedical Techniques and Laboratory Management	50							
II	<b>Microbiology - II</b> <b>Paper title:</b> Clinical Microbiology & Molecular Biology	100	20	120	40	10	30	80	200
	<b>Section A :</b> Clinical Microbiology	50							
	<b>Section B :</b> Molecular Biology	50							
III	<b>Hematology &amp; Blood Transfusion-II</b> <b>Paper title:</b> Hematology, Clinical Pathology & Medical Genetics	100	20	120	40	10	30	80	200
	<b>Section A :</b> Hematology	50							
	<b>Section B:</b> Clinical Pathology & Medical Genetics	50							
	<b>Grand Total</b>	300	60		120	30	90		600

**Table- III Distribution of teaching hours & marks in Second year  
[3<sup>rd</sup> semester] as per the selection of branch in M.Sc MLT**

**BRANCH ( Clinical Microbiology)**

**Table III (a) Distribution of teaching hours -3<sup>rd</sup> semester in clinical microbiology**

paper	Subject	Theory No. of hours	Practical 2hours/class	Total
01	<b>Paper-I Microbiology</b> Paper Title: Systemic Bacteriology & Immunology	80	80	160
02	<b>Paper-II Microbiology</b> Paper title: Virology & mycology	80	80	160
				320

**Table III (b) Distribution of marks -3<sup>rd</sup> semester clinical microbiology**

Paper	Subject	Theory marks			Practical marks				Grand total
		Theory	IA	Sub total	Practical	IA	Viva voce	Sub total	
I	<b>Paper I Microbiology</b> Paper title: Systemic Bacteriology & Immunology	100	20	120	40	10	30	80	200
II	<b>Paper II Microbiology</b> Paper title: Virology & mycology	100	20	120	40	10	30	80	200
		Grand Total							400

**Table- III (c) Distribution of teaching hours & marks in Second year  
[4<sup>th</sup> semester] as per the selection of branch in M.Sc MLT**

**BRANCH ( Clinical Microbiology)**

**Table III (d) Distribution of teaching hours -4<sup>th</sup> semester in clinical microbiology**

Paper	Subject	Theory No. of hours	Practical 2hours /class	Total
01	<b>Paper-I Microbiology</b> Paper title: Systemic Bacteriology, Applied Microbiology and Immunology	80	80	160
02	<b>Paper-II Microbiology</b> Paper title: Virology & mycology	80	80	160
				320

**Table III (e) Distribution of marks -4<sup>th</sup> semester in clinical microbiology**

Paper	Subject	Theory marks			Practical marks				Grand total
		Theory	IA	Sub total	Practical	IA	Viva voce	Sub total	
I	<b>Paper I Microbiology</b> Paper title: Systemic Bacteriology, Applied Microbiology and Immunology	100	20	120	40	10	30	80	200
II	<b>Paper II Microbiology</b> Paper title: Virology & mycology	100	20	120	40	10	30	80	200
III	<b>Project work</b>	80					20		100
		Grand Total							500

## **9. MONITORING PROGRESS OF STUDIES**

### **WORK DIARY/RECORD BOOK**

Every candidate shall attend symposia, seminars, conferences, journal review meetings & lectures during each semester as prescribed by the department and not absent him/her from work without valid reasons. Every candidate shall maintain a work diary and record of his/her participation in the training Program. Special mention may be made of the presentations by the candidate as well as details of laboratory work conducted by the candidate. The work diary and record shall be scrutinized and certified by the concerned faculty members.

### **INTERNAL ASSESSMENT (IA)**

Institutions running the course shall conduct two tests each in every semester for Internal Assessment as per the University prescribed calendar of events. The marks obtained in these tests will be considered for internal assessment. Average of the two marks will be computed for internal assessment and shall be sent to the university as per the notification issued by Registrar (Evaluation) before each university examination. Records and marks obtained in tests will be maintained by the college and made available to the university. Marks of periodic tests shall be displayed on the notice board by the principals without fail.

Note: If a candidate is absent for the test due to genuine and satisfactory reason, such a candidate may be given a re-test within a fortnight.

The distribution of marks for internal assessment for subjects of study in first year and second year are shown in Tables III and IV respectively.

## Distribution of Internal Assessment marks (Subject Wise)

Course: M.Sc MLT (I &II semester)

SL. No.	Subject	Theory/ paper	Practical / paper
01	Biochemistry I& II Paper title: Clinical biochemistry, Biomedical technique & Laboratory management	20	10
02	Microbiology I Paper title: Clinical microbiology and immunology Microbiology II Paper title: Clinical microbiology and Molecular biology	20	10
03	Hematology & Blood Transfusion I Paper title: Hematology, clinical pathology & immunopathology Hematology & Blood Transfusion II Paper title: Hematology, clinical pathology & Medical Genetics	20	10

Branches: M.Sc MLT in Clinical Biochemistry/ Clinical Microbiology/ Haematology & Blood Transfusion

SL. No.	Subject	Theory/ paper	Practical / paper
	<b>Paper-I Microbiology</b> <b>Paper title:</b> Systemic Bacteriology, Applied Microbiology and Immunology	20	10
	<b>Paper II Microbiology</b> <b>Paper title:</b> Virology & mycology	20	10

Note:

a) students must secure at least 50% of total marks fixed for Internal Assessment for a particular subject in order to be eligible to appear in University examination in that subject

b) Internal Assessment marks will be added to the marks obtained in the University Examination.

**NOTE:** A student must secure at least 50% of total marks fixed for internal assessment for a particular subject in order to be eligible to appear in university examination in that subject. The internal assessment marks **will be added** to the marks obtained in the university examination for declaration of pass.

### 10. PROJECT WORK

Each candidate pursuing M.Sc. MLT Course in the selected specialisation is required to carry out dissertation work on a selected topic in the area of specialisation under the guidance of a recognized post graduate teacher after successful completion of first year of the course (1<sup>st</sup> & 2<sup>nd</sup> semester).The candidate has to commence the project work during

the third semester and should complete the same in the fourth semester. The completed project should be submitted to University one month prior to the fourth semester University examination through Head of the department duly certified by the Guide.

The project work is aimed to kindle the research instincts among the students. The work should comprise adequate exposure to various research methodologies and techniques. Which includes identification of problem, formulation of hypothesis, search and review of literature, getting acquainted with recent advances, collection of data, interpretation of results and drawing conclusions.

University shall arrange for evaluation of the project work both internally and externally and shall have to obtain 50% of the total marks allotted for the project work including viva voce [80marks for project and 20marks for viva voce]

The University shall arrange for review of synopsis and if found suitable shall register the dissertation topic. No change in the dissertation topic or guide shall be made without prior approval of the University.

The project report shall have the following components.

- ☐ Introduction
- ☐ Aims or objectives of study
- ☐ Review of literature
- ☐ Materials and methods
- ☐ Results
- ☐ Discussion
- ☐ Conclusion
- ☐ Summary
- ☐ References
- ☐ Tables
- ☐ Annexure

The written text of project work shall not be less than 50 pages and shall not exceed 100 pages excluding references, tables, questionnaires and other annexure. It should be neatly

typed in double line spacing on one side of paper (A4 size, 8.27" x 11.69") and bound properly. A declaration by the candidate to the effect that the work was done by him/her and a certificate of bonafide on the research work from the have to be affixed in the beginning of the project report. Five copies of project report should be submitted to the University through proper channel along with a soft copy (CD) one month before the final

examinations.

## 11. GUIDE

The eligibility academic qualification and teaching experience required for recognition as Guides by the SDUAHER are:

### a) ELIGIBILITY TO BE A GUIDE

Shall be a full time teacher in the college or institution where he or she is working..

### b) Academic qualification and teaching/professional experience for each M.Sc. MLT-Clinical Microbiology & Immunology

1. M.D. or Ph.D. in Microbiology and three years teaching/professional experience after post-graduation in a teaching in medical institution or in a laboratory approved by RGUHS,  
or
2. M.Sc. MLT in Clinical Microbiology & Immunology with five years of teaching/professional experience after the postgraduate qualification in a teaching in medical institution or laboratory approved by RGUHS.

c) **Age:** The age of guide shall not exceed 65 years.

### d) STUDENT: GUIDE RATIO

5:1. As a guide or co-guide shall supervise dissertation work of not more than five students per academic year.

## 12. SCHEDULE OF EXAMINATION

- a. The University conducts four semester examinations during course period. Each year consists of two semesters, each semester consists of Ninety working days. Examination should get over during the period of six months of a semester.

The number of examiners for practical and viva-voce shall be two, comprising of one internal and one external examiner appointed by the university.

- b. A candidate shall not be admitted to the practical examinations for the first time unless he/she produces the practical record book certified by the Head of the Department.
- d. A failed candidate needs to appear for both theory and practical examination in the failed subject/s only in the subsequent examination.

## 13. SCHEME OF EXAMINATION:

### University examination:

There shall be four University semester examinations, two at the end of first year and the other two the end of second year respectively.

## **First Year MSc MLT**

Both the main and subsidiary subjects for M.Sc. MLT course shall be common for all the three branches.

### ***Eligibility to appear in university examination***

A candidate shall be eligible to appear for first year M.Sc. MLT examination at the end of each semester in the Academic year from the commencement of the course. He/she should have satisfactorily completed the prescribed course fulfilment with prescribed attendance.

**Written examination:** Written examination shall consist of three theory papers each of three hours duration. Each paper shall carry 100 marks.

**Practical examination:** There shall be one practical examination at the end of each semester in first year and second year subjects. Each practical examination carries 100 marks.

**Viva- voce :** - This shall aim at assessing depth of knowledge, logical reasoning, confidence and oral communication skills. Both internal and external examiners shall conduct the viva-voce. Total marks shall be 30. The particulars of subjects for examination and distribution of marks are shown in the Table -V.

## **Second year M.Sc MLT[3<sup>rd</sup> & 4<sup>th</sup> semester]**

Examination in II year (3<sup>rd</sup> & 4<sup>th</sup> semester) shall be held separately for each branch. A candidate will appear only in the branch chosen by him/her at the time of admission.

**Eligibility:** To be eligible to appear in the II year examination (3<sup>rd</sup> & 4<sup>th</sup> semester) a candidate shall have Completed first year of study (1<sup>st</sup> & 2<sup>nd</sup> semester) and passed in all the subjects of I year.

**Written examination :** Written examination shall consists of two theory papers. Each paper shall be of three hours duration. Each paper shall carry 100 marks.

**Practical examination:** There shall be one practical examination in each of the branches . The marks for each practical examination shall be 40 marks.

The duration of practicals from 9.00 a.m. to 5.00 p.m. with a lunch break of one hour in between for each of the branches is as follows:

## M.Sc. MLT Clinical Biochemistry II Practical - 2 days

**(Viva- voce :** This shall aim at assessing depth of knowledge, logical reasoning, confidence & oral communication skills. Total marks shall be 30. Presentation of dissertation and discussion on it be done during the viva-voce . No marks shall be awarded to the presentation of dissertation. Both internal and external examiners shall conduct the practical and viva- voce examination. The particulars of subjects for examination and distribution of marks are shown in the Table. III (b) & (e), IV (b) &( e)

### **14. CRITERIA FOR PASS.**

#### **Pass criteria in a subject**

For declaration of pass in any subject in the University examination the candidates shall pass both in theory and practical examinations components separately as stipulated below;

Theory 50%, which includes marks obtained in written examination, internal assessment and viva voce.

Practical 50% which includes marks obtained in practical examination, practical Internal assessment.

A candidate has to pass in theory and practical separately to pass in a subject in the University examination.

A failed candidate is required to appear for both theory and practical in the subsequent examination in that subject.

#### **b. Criteria for pass in University semester end examination First year [1<sup>st</sup> &2<sup>nd</sup> semester] and II year [3<sup>rd</sup> &4<sup>th</sup> semester]**

To consider as pass in University semester end examination, candidate has to appear in all the papers prescribed and has to fulfil pass criteria.

### **15. CARRY OVER**

A Candidate who has admitted to postgraduate programs under the faculty of Allied health and basic sciences shall be permitted to carry over the backlog subject till the completion of duration of the programme.

However she/ he shall be declared passed in the programme only after successfully passing all the subject/ courses of all semesters of the post graduate programme

## **16 DECLARATION OF DISTINCTION:**

A candidate securing aggregate marks of 75% or more in the first attempt shall be declared as passed with distinction. Distinction will not be awarded for candidates passing the examination with more than one attempt.

## **17. MAXIMUM DURATION FOR COMPLETION OF COURSE**

The maximum duration of the programme shall be four years from the date of admission  
The candidate failing to complete the course within four years from the date of admission will be declared unfit to continue and will be discharged from the programme.

## **18. ELIGIBILITY FOR AWARD OF DEGREE**

A candidate shall have passed in all the subjects of first year ( 1<sup>st</sup> and 2<sup>nd</sup> semester) and second year ( 3<sup>rd</sup> and 4<sup>th</sup> semesters) to be eligible for award of degree.

## **MINIMUM REQUIREMENT OF FACULTY AND INFRASTRUCTURE FOR M.SC. MLT COURSE**

### **1. Basic Infrastructure to all three specialities:**

1. Institute should have its own Hospital with full-fledged central diagnostic laboratory centre to fulfil the minimum work load criteria for each of the subject speciality is here under.

### **Basic Laboratories:**

1. clinical biochemistry, clinical microbiology and clinical pathology laboratories with area of 800sq.ft each
2. One lab for Immunopathology 10x10 sqft with power back -up
3. One class room with capacity for 30 students measuring 500sq.ft.
4. One ICT enabled departmental Seminar room measuring 250sq.ft for each specialty with compulsory.

Other infrastructure criteria- Principals room, student's common room, staffroom, Library, office room, Store room, preparation room etc will be as per minimum criteria. Norms of B.Sc MLT course.

### **II. Infrastructure subject wise: Biochemistry**

#### **a. Laboratory equipments**

1. Chemical Balance/single Pan Balance
2. Colorimeter
3. Spectrophotometer
4. Flame Photometer/ ISE Electrolyte analyser
5. pH meter
6. Chromatography instruments
7. Electrophoresis unit
8. Semi

auto analyser/ 9. Auto analyser 10. Chemiluminescence / Drug and Hormone analyser (optional) 11. Blood gas analyser 12. Refrigerator

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

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

### **Man power requirement for clinical biochemistry / Microbiology and Immunology/ Haematology and Blood transfusion**

SI No	Posts	requirement
01	Professor	01
02	Assoc professor	01
03	Asst professor	01
04	lecturer	02
05	tutors	02
06	Technical staff	03

#### **Staff requirement for each department**

Teaching staff: Should actively involve in teaching the particular subject: Qualification: 1. MD in respective subject

1. MSc -only Medical Microbiology/Medical Biochemistry degree acceptable) with 3 years' experience after MSc. 2. D.C.P - 2 years' experience 3. Bio-technologist - MSc in Biotechnology

Teaching staff requirement for each speciality

1.) Professor – 1, 2.) Associate Professor (1 - 5yrs teaching experience), 3. Assistant Professor (1- 3yrs teaching experience) 4. Lecturer – 2, 5). Tutors - 2 MBBS, MSc. Technical staff - senior technician – 1, Junior technician – 2 and a Peon - 1

## **SYLLABUS**

### **I. BIOCHEMISTRY – I (First semester)**

Paper Title: Clinical biochemistry, biochemical technique and Laboratory management (50 hours)

#### **SECTION A : CLINICAL BIOCHEMISTRY (25 hours)**

##### **1. CARBOHYDRATES**

General description of carbohydrates

Chemistry: classification, stereoisomers, monosaccharides, disaccharides and polysaccharides.

Chemical properties of carbohydrates. Glucose metabolism, Metabolic fate of glucose, Regulation of blood glucose homeostasis.

Hyperglycaemias: Diabetes mellitus, laboratory findings in type 1 and type 2 DM, gestational DM.

Diagnostic and monitoring criteria for DM. The role of laboratory in differential diagnosis of patients with glucose metabolism alteration

- a) Methods of glucose measurement
- b) Glucose Tolerance test
- c) Glycosylated Hemoglobin
- d) Ketones
- e) Microalbuminuria
- f) Islets antibodies and insulin testing

##### **2. PROTEINS**

Chemistry of proteins/plasma proteins in health and disease. Total protein abnormalities (hypo and hyper proteinemia) methods of protein analysis (total protein), electrophoresis, capillary electrophoresis isoelectro focussing, immunochemical methods,

Non protein nitrogen substances: biochemistry, clinical application, analytical methods, pathophysiology of a) urea b) uric acid c) creatinine d) ammonia

##### **3. LIPIDS (10hours)**

Chemistry of lipids [fatty acids/TAG/phospholipids/ cholesterol]. General lipoprotein structure, types, formation and clinical significance of chylomicrons/VLDL/IDL/LDL/HDL/lipoprotein X

Diagnosis of lipid disorders

Lipid lipoprotein analysis:[lipid profile]: a) total lipids b) cholesterol c)TAG d)HDL e)LDL f)phospholipids g) fatty acid

##### **4. ENZYMES (05 hours)**

Definition and general properties, classification and nomenclature

Enzyme kinetics; mechanism, factors influencing enzyme activity, measurement of enzyme activity, calculation of enzyme activity, measurement of enzyme mass.

Enzymes of clinical significance: creatine kinase LDH /ALT/AST /ALP/ACP/GGT/amylase/lipase

#### 5. NUCLEIC ACIDS (05 hours)

Nucleotides and analogues, Nucleotides functions, structural details of DNA and types. RNA and classification. Isolation and Purification of DNA.

#### **PRACTICALS- CLINICAL BIOCHEMISTRY (50 hours)**

Laboratory safety and regulations

Safety awareness for clinical laboratory personnel

Estimation of blood glucose by Ortho toluidine method

Estimation of blood glucose by GOD – POD method.

Estimation of protein by Biuret method, Lowry, UV method

Estimation of serum creatinine by Jaffe's method

Estimation of urea in blood sample by urease

Estimation of Total cholesterol by CHOD/POD method

Estimation of Triglycerides by GOP/PA method

Estimation of HDL Cholesterol by precipitation method

## **Section B: BIOMEDICAL TECHNIQUES AND LABORATORY MANAGEMENT (25 hours)**

### **BIOMEDICAL TECHNIQUES**

(15 hours)

#### **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.

#### **Centrifugation techniques:**

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

#### **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.

**Isotopes:** Detection and measurement of radioactive isotopes, application of isotopes in research and clinical bio-chemistry.

### **PRACTICALS UNDER BIOMEDICAL TECHNIQUES**

**Chromatography:** paper, thin layer, ion exchange, gel chromatography, demonstration of HPLC and GLC

**Electrophoresis;** slide gel, PAGE, Agarose, SDS-PAGE demonstration

### **LABORATORY MANAGEMENT SYSTEM (10 HOURS)**

#### **Cost-analysis (tests and instruments)**

Preparation of operating budgets; general aspects of financial management of laboratories justification of providing new services or rejecting existing ones; lease and purchase decision analysis; delegation of budget responsibilities, work load statistics.

### **Laboratory design**

Designing laboratories for different types and sizes of institutions: selection of equipment and systems for the laboratory, concepts of workstation consolidation, workflow concepts in laboratory automation (sample transportation systems, modular robotics).

### **Laboratory safety:**

Fire, chemical, radiation and infection control (body substance precautions), hazardous waste and transport of hazardous materials

### **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

### **Maintenance of records:**

Procedure manuals, ward manuals, quality control programs, patient data retrieval.

### **Personnel management:**

Personnel policy manual; job descriptions; labour, supervision relations; conducting job interviews; motivation, recognizing job distress syndrome; delegation to a laboratory manager.

### **Hospital organization;**

interactions between the laboratory service and the rest of the hospital. Professional ethics.

**Quality assurance;** total quality management; development and monitoring of performance indicators.

Note: Laboratory Management has field work

## **II SEMESTER**

### **BIOCHEMISTRY-II**

**Paper Title:** Clinical biochemistry, biomedical technique and Laboratory management (50 hours)

#### **Section A- Clinical Biochemistry**

##### **Clinical Significance: Principle of Estimation**

Formation and detoxification of bilirubin, types, differential diagnosis of jaundice, bile salts and bile pigments. Method of detection.

Quantification of bilirubin by Mally evlyn method, jenddrassrk and Gorf method direct spectrophotometry method.

Estimation of Alkaline phosphatase and Acid phosphatase by kings method

Assay of SGOT and SGPT by Reitman and Frankel method

Gastric juice analysis

Insulin tolerance test

Xylose absorption test

Analysis of calculi

Composition and function of CSF , clinical significance of fluid analysis, estimation of sugar and protein in CSF

##### **Urine chemistry**

Physical and chemical examination of urine sample, qualitative tests for inorganic ingredients, common qualitative and quantitative tests for urine, clearance tests

Automation in urine chemistry

##### **Electrolytes**

Sodium, potassium, chloride, total and ionised calcium, phosphorous magnesium, blood gas and pH, carboxy haemoglobin, carbon monoxide, methaemoglobin, oxygen saturation.

Blood collection procedure and theory of anticoagulation.

Biomedical wastes, types, potential risks and their safe management.

## **II semester**

### **Section A : Clinical biochemistry practical**

Estimation of SGOT in blood sample by kinetic method

Estimation of SGPT in blood sample by kinetic method

Estimation of alkaline phosphatase in blood sample by kinetic method

Estimation of acid phosphatase in blood sample by kinetic method

Estimation of bilirubin in blood sample by kinetic method

Estimation of Na<sup>+</sup>, K<sup>+</sup> & Ca<sup>++</sup> by electrode analyser

Estimation of common parameters in urine through use of strips

Estimation of T3, T4 and TSH by ELISA method.

## Section B

### Biomedical techniques and laboratory management (25 hours)

#### Biomedical techniques (15 hours)

	Cell Fractionation, Biochemical activities of different fractions, marker enzymes
Bioenergetics and Biological oxidation	Concept of free energy change, high energy compounds, ATP generation, redox potential Internal Assessment, Electron transport chain, oxidative phosphorylation, inhibitors, Uncouplers, ionophores.  Purification of enzymes from cells, characterization and criteria Internal Assessment of purity, purification of proteins.  Bio-Medical waste: Types, potential risks and their safe management.

#### PRACTICALS on Biomedical Techniques

1. Photometry,
2. spectrophotometry,
3. atomic absorption spectrophotometry
4. Cell fractionation -methods

## **LABORATORY MANAGEMENT ( 10 hours)**

Public relations; hospital and community

Basic clinical epidemiology

Laboratory Data Processing:

General principles of methods for reduction of data into forms suitable for electronic data handling systems (computerized functions, sample identification and tracking (e.g. bar code systems), result reporting, storage and retrieval, electronic data transfer).

Use of computers in quality control and management; use of computers for calculating analytical results (eg. non-linear functions).

General aspects of system design; central vs. stand-alone systems, host computers and equipment interfaces.

Laboratory information systems (LIS), Hospital information systems (HIS).

Personal computer use: word processing, spreadsheets, graphics, statistics, presentations, email, internet. Security of data storage and transmission.

Data base structures and data mining.

Appropriate access control to patient information

Note: Laboratory Management has field work

### **Reference Books:**

1. Biochemistry – Strayer H. Gerjmetal-W.H. Freeman and company New York 5th edn 2002.
2. Lehninger's Principles of Biochemistry – Lininger. A.L., Nelson. D.L., Eral-C.B.S. Publishers & distributors, New Delhi 3rd edition.
3. Harper Illustrated Biochemistry – Murray R.K. Grannar, D.K. Mayes-P.A. Eral 26th edition, McGraw Hill. 2003.
4. Medical Biochemistry – N.V. Bhagavan -Academic Press 4th edition 2002.
5. Text Book of Biochemistry – A.S. Saini, C.B.S Publishers and distributors 2nd edition.
6. Teitz fundamentals of Clinical Chemistry – Burtis. C.A. Ashoowd E. R. – Har Court (India) Ltd 5<sup>th</sup> edition 2001.
7. Varley's Practical Clinical Biochemistry – Gowenlock and Bell William Heinemann, 6th edition 1992.
8. Text Book of Biochemistry with Clinical Correlations – Devlin T.M. Wiley Liss, New York 5th Edition 2002.
9. Clinical Physiology of Acid-Base balance and Electrolyte disorders – Rose. B.D – Mcgraw-Hill International edition New York 4th edition 1994.

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. 2nd edition 1989.
13. Principles of Biochemistry – CBS Publishers – Lehninger, Nelson, Cox.

## SCHEME OF EXAMINATION OF BIOCHEMISTRY

Theory: - Their shall be one paper of 3 hrs duration, carrying 100 marks each in semester

### PAPER I:-Biochemistry-I

**Title:** Clinical Biochemistry, Biomedical Techniques and Laboratory management

Sec A: - Clinical Biochemistry -50 marks

Sec B: - Biomedical Techniques and Laboratory Management -50 marks

Type of questions and distribution of marks for each section carrying 50 marks in theory subjects

Section A and section B			
Type of questions	No of questions	Marks for each questions	Total
Long Essay	01	20	20
Short Essay	05	06	30

### PRACTICAL EXAMINATION

**Max Marks: 70**

Experiments ( 40 marks) , Viva voce 30 (marks)

1. Identification of Unknown Carbohydrate, Protein or NPN - 15 Marks
2. Practicals: A - 15 Marks

Procedures involving Chromatography or Electrophoresis to be given for seperation and identification of aminoacids or carbohydrates.

Practicals: B - 10 Marks

Estimation of Glucose, Total protein, Creatinine, Urea, Cholesterol (any one)

VIVA-VOCE----30 Marks

**The Viva Voce exam will carry 30 marks and both the internal and external examiners will conduct the examination**

Note: each theory paper for 100 marks, Theory internal assessment 20 marks, viva voce 30 marks, practicals 40 marks, & practical internal assessment 10 marks. Thus each subject is for

200 marks

### 3.1 SYLLABUS

#### **MICROBIOLOGY - I (FIRST SEMESTER)**

Paper Title: Clinical Microbiology & Immunology (50 hours)

Section A: Clinical Microbiology

Section B: Immunology

#### **SECTION A: CLINICAL MICROBIOLOGY (25 hours)**

##### **General aspects:**

The investigation of biological samples in infectious diseases is different from the other branches in that it requires general knowledge of pathogenic agents (bacteria or viruses) and of host reaction.

##### **Definition of infection and infectious disease:**

natural bacteriological ecosystem. Pathogenicity of bacteria and viruses. General epidemiology of infection and infectious diseases. Sterilization & Disinfection Culture media and preparation Bacteriology of Milk, Water and Air

##### **Diagnostic procedures:**

Specimen selection and collection (blood, urine, sputum, faeces, others).

Specimen processing: smears, staining, cultures including cell cultures, susceptibility testing, antigen detection. Preservation of cultures Usual techniques for microbe and virus identification (including principal differential characteristics).

Molecular biology techniques for characterization of microbes and viral agents. Bacteriological and viral serology.

##### **Bacterias:**

Succinct description of responsible bacterial and viruses in bacteriological and viral syndromes or diseases (including principal differential characteristics).

**Bacterial:** Neisseria gonorrhoeae and N. meningitidis, Staphylococcus aureus, Coagulase Negative Staphylococcus, Streptococcus pyogenes (especially S. agalactiae and S. pneumonia), Escherichia coli, Salmonella, Shigella and other Enterobacteriaceae, Vibrio cholerae, Pseudomonas aeruginosa Haemophilus influenzae, Clostridium perfringens, C. tetani, Bacteroides spp, Lister monocytogenes, Legionella, Mycobacterium tuberculosis and others, Treponema pallidum,

Chlamydia, Mycoplasma, etc. Corynebacterium diphtheriae, Bacillus anthracis, B.cereus, Non sporing Anaerobes, Bordetella, Brucella, Yersinia, Actinomyces, Pasteurella, Francisella,

**Section A clinical microbiology practicals (25 hours)**

Collection of clinical materials like blood, urine, stool, sputum, swabs, CSF etc.

Procedure of techniques of sputum for AFB.

Procedure of skin clipping of Leptrae Bacilli

Identification of organisms with Biochemical reactions of common organism like - Staphylococcus, E.coli - Klebsiella, shigella, Salmonella, Proteus, Pseudomonas

Antibiotic Sensitivity tests

Preservation of stock culture

Bacteriology of water

## **SECTION B: IMMUNOLOGY (25 hours)**

### **BASIC IMMUNOLOGY**

#### **Characteristics of the Immune system:**

Define CD antigens.

Define primary and secondary lymphoid tissues.

Define mucosal-associated lymphoid tissues.

oral

nasopharyngeal

gut-associated

reproductive

Describe blood-lymph circulation and lymphatics.

Organization of lymph nodes

Explain hematopoietic cell distribution in lymph nodes.

Provide examples and locations of lymph nodes in head and neck.

#### **Innate and Adaptive Immunity:**

Define concepts of specificity and memory.

Describe basic properties of innate immune cells.

Describe basic properties of adaptive immune cells.

#### **Physiochemical Properties of innate immunity:**

Physiological barriers

Anatomical barriers

Phagocytic/endocytic barriers

Inflammatory barriers

#### **Adaptive Immunity:**

Define humoral immunity.

Define cell-mediated immunity.

Define T cells, T cell subsets, B cells, and plasma cells.

#### **Antigens and Immunogens :**

Define antigen and immunogen.

Define relative antigenicity of macromolecules.

Define and give example of antigenic determinants and epitopes.

List types of antigens with examples.

Define 'Hapten' and explain how they function in the immune system

#### **Immunoglobulins (Igs)/ Antibodies (Abs):**

source from B cells and plasma cells

B cell/antibody/specificity relationship

Describe structure of immunoglobulins:

Molecular components of Igs

heavy and light chains

variable and constant regions  
Define allotype, isotype, idiotype.

**Classification of immunoglobulins:**

Explain differences based on heavy and light chains.  
Describe functional properties of Ig classes.  
Describe evidence for number of antigenic determinants recognized by Igs.

**T cells:**

Describe classification of T cells (Th1, Th2,  $\alpha\beta$  and  $\gamma\delta$  T cells).  
Compare and contrast molecular and cellular features of T cell receptor (TCR) to B cells receptor (Ig molecule).  
Describe development of T cells in the thymus.  
Describe the genes' rearrangement in TCR development.  
T cell-associated molecule - the TCR complex  
CD3 molecules  
T cell signaling by CD3  
Define  $\alpha\beta$  and  $\gamma\delta$  T cells, including tissue distribution  
differential functions of  $\alpha\beta$  and  $\gamma\delta$  T cell.

**The Complement system:**

Define the complement system and describe when and how it is used.  
Provide step-by-step examples of how complement works:  
the classical complement pathway  
the alternate complement pathway  
List representative infectious agents and products that activate complement.  
Describe biological effects mediated by complement.  
Describe the effects of complement on the immune system.  
Describe the significance of complement at oral mucosal surfaces.

**Antigen Processing and Presentation:**

Describe use as a function of T cell activation.  
Describe cells involved in antigen processing and presentation.

**The Major Histocompatibility complex (MHC):**

Describe gene nomenclature for MHC antigens.  
List the numbers of human MHC genes.  
Explain the tissue distribution of MHC antigens.  
Describe the structure of MHC Class-I and Class-II molecules.  
Describe, with examples, how peptide antigens are processed.

**Cell-Mediated Immunity (CMI):**

Describe the cells involved in CMI and the role played in the immune response.  
Describe the mechanisms of tissue cell destruction by T cells.  
Describe concept of 'Memory T Cell'.  
Define Natural Killer (NK) cell.  
Define 'Super Antigen' and give examples in disease.

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

**Section B: PRACTICALS On Immunology (25 hours)**

VDRL Tests

Brucella Agglutination test

Weil felix test (Demonstration only)

Paul Bunnell test (Demonstration only)

RA test

CRP test

TPHA

ELISA

ASLO

WIDAL

### 3.1 SYLLABUS

#### Microbiology-II (Second semester)

**Paper Title: Clinical Microbiology & Molecular biology (50 hours)**

Section A: Clinical Microbiology  
Section B: Molecular Biology

#### **SECTION A: CLINICAL MICROBIOLOGY (25 hours)**

##### **Viruses:**

Viruses: herpes (herpes simplex, herpes varicellae, cytomegalovirus, Epstein Barr virus); hepatitis A, B, C, D, E; human immunodeficiency virus; enteroviruses (poliovirus); rubella, mumps, measles, parvovirus B19, RSV, myxovirus, rhinovirus, coronavirus, adenovirus, rotavirus, papillomavirus, rabies, Arboviruses, Poxviruses, Oncogenic Viruses, etc

##### **Antibiotics and antiviral agents:**

Basic knowledge of antibiotics and antimicrobial therapy.

Antibiotic and antiviral sensitivity test.

Antibiotic and antiviral resistant mechanisms

##### **Medical Parasitology & Mycology:**

Epidemiology, main clinical signs, basis for biological diagnosis (including a succinct description of parasites and fungi without biochemical characteristics), treatment.

Amoebiasis: Entamoeba histolytica. Giardiasis, cryptosporidiosis and uro-genital trichomoniasis. Malaria. Toxoplasmosis. Intestinal, hepatic and urinary helminthiasis:

strongyloidiasis, ancylostomiasis, enterobiasis, ascariasis, schistosomiasis (Schistosoma mansoni and S haematobium), fascioliasis (Fasciola hepatica) and taeniasis (Taenia saginata). Fungal infections (Candida albicans, Cryptococcus neoformans, etc.).

Aspergillus infections (Aspergillus fumigatus). Dermatophyte infections (Microsporum canis, Epidermophyton floccosum, Trichophyton rubrum, Trichophyton mentagrophytes).

Leishmaniasis. Echinococcosis. Pneumocystosis. Filariasis. Leptospirosis

##### **Bio-medical waste:**

Usual techniques for parasite and fungus identification

Immunological and molecular diagnosis of parasitic and mycological diseases. Bio-Medical waste

Types, potential risks and their safe management.

## **Section A: PRACTICALS on clinical microbiology (25 hours)**

Parasitology - collection, preservation and transportation of faecal material for examination of parasites. Concentration techniques of stool for ova and cyst. Wet preparation of faecal sample for ova and cyst. Identification of ova and cyst in stool sample.

Collection of specimen for fungal examination like skin scrapings, swabs, CSF.

Fungal examination by wet preparation

Fungal culture

ELISA HIV & HBsAg test

Western blot test

Incubation of fertile eggs and inoculation by various routes.  
(Demonstration only)

## **Section B: MOLECULAR BIOLOGY (second semester)**

DNA: the support of Hereditary information

Structure, types, coiling and supercoiling, topoisomerases, replication, satellite DNA. Organisation of Prokaryotic and Eukaryotic genome, chromosomes structure, number, sex chromosomes, human karyotype, methods for chromosome analysis, chromosome banding, FISH, CGH, Flow cytometry, Cell cycle, mitosis and meiosis.

Transcription and translation factors involved, RNA processing, types of RNA, genetic code, Lac operon, Tryptophan operon, regulation in eukaryotes, gene dosage and gene amplification, generation of antibody diversity.

Mutation spontaneous, induced, point mutation and silent mutation, frameshift mutation, physical and chemical mutagens, molecular basis, site directed mutagenesis, significance mutagenesis, DNA repair, isolating mutants, Ames test.

Recombinant DNA technology: Necessary elements – enzymes and vectors – plasmids, cosmids, bacteriophages, vectors, expression vectors, construction of rDNA and cloning strategies – various methods, genomic libraries (e.g. using phage vectors), cDNA libraries, introduction of rDNA into host – methods, restriction maps and sequencing

Genetics in medicine:

Hemoglobin and hemoglobinopathies, phenylketonuria, alkaptonuria, homocystinuria, Lesch-Nyhan syndrome, genetics of cancer, Down's syndrome, Di-George syndrome, Klinefelters syndrome, Turner's syndrome, hermaphroditism, cystic Fibrosis, haemophilia, prenatal diagnosis of genetic diseases, application of recombinant DNA Technology in medicine – PCR, RFLP, DNA finger printing, therapeutic proteins, vaccines, antibodies, transgenic organisms, gene therapy, human genome project.

**Section B : PRACTICALS on Molecular Biology (25 hours)**

PCR- Site Directed Mutagenesis

DNA Isolation and purification

DNA Cloning,

Bacterial Transformation and Fusion

Protein Purification

Plasmid Analysis by Restriction Digestion

Protein Gel Electrophoresis

DNA Gel Electrophoresis

### **References:**

1. Text book of Microbiology by Ananthnarayan, 6 th Edition, Orient Longman
2. Diagnostic Microbiology by Bailey & Scott 11th Edition; Mosby  
Medical Microbiology by Greenwood & Slack 16th Edition; Churchill Livingstone
3. The Short Textbook of Medical Microbiology by Satish Gupte 8th Edition; Jaypee

4. Text book of Medical Parasitology by Panikar 5th Edition; Jaypee
5. Colour Atlas and Textbook of Diagnostic Microbiology by Koneman 5th Edition, Williams Wilkins
6. District Laboratory in Tropical Countries, Monica Cheesbrough 1st Edition, Cambridge
7. Mackie & Maccartney Practical Medical Microbiology 14th Edition; Churchill Livingstone
8. Essential Immunology, Roitts & Delves 10th Edition; Blackwel Science

### **SCHEME OF EXAMINATION OF MICROBIOLOGY**

Theory: - Their shall be one paper of 3 hrs duration, carrying 100 marks each in semester

#### **PAPER I:-Microbiology-I**

**Title:** Clinical Microbiology, Immunology & Molecular Biology

Sec A: - Clinical Microbiology -50 marks

Sec B: - Immunology & Molecular Biology -50 marks

Type of questions and distribution of marks for each section carrying 50 marks in theory subjects

Section A and section B			
Type of questions	No of questions	Marks for each questions	Total
Long Essay	01	20	20
Short Essay	05	06	30

#### **PRACTICAL EXAMINATION**

**Max Marks: 70**

Experiments ( 40 marks) , Viva voce 30 (marks)

Identification of Bacterial culture, spotters, stool examination, acid fast stain, albert's stain, serology exercise, mycology exercise

VIVA-VOCE----30 Marks

The Viva Voce exam will carry 30 marks and both the internal and external examiners will conduct the examination

Note: each theory paper for 100 marks, Theory internal assessment 20 marks, viva voce 30 marks, practicals 40 marks, & practical internal assessment 10 marks. Thus each subject is for 200 marks

### 3.1 SYLLABUS

#### HAEMATOLOGY AND BLOOD TRANSFUSION -I (FIRST SEMESTER)

Paper Title: Haematology, Clinical Pathology and Immunopathology (50 hours)

Section A Haematology, (25 hours)

**Haemotopoiesis:**

Origin, development, function and fate of blood cells.

**Erythropoiesis:**

Origin, development of RBCs, biosynthesis of Hb, control of Erythropoiesis

Disorder's of Red blood cells, Erythrocyte Indices, Red cell inclusion bodies

Anaemia, definition, Pathophysiology, classification - morphologic and Etiologic classification and clinical features. Investigations in a case of anaemia.

**Morphologic:** Microcytic hypochromic anaemia, macrocytic anaemia.

**Haemolytic anaemias:** Definition, classification, clinical features

Investigations to establish a case of haemolytic anaemia.

**Tests done:**

Peripheral smear – specific morphologic abnormalities

Reticulocyte count Corrected reticulocyte count Reticulocyte production index

Osmotic fragility test

Coomb's test

Sickling phenomenon

Kleihauer acid Elution test

Alkali denaturation test

Ham's test, Sucrose lysis Test

Electrophoresis – HbF & Hb A2 estimation

Test for G6PD deficiency

Aplastic anemia. Pancytopenia, Anemia due to abnormal globin synthesis

Polycythaemia.

**Disorders of white Blood cells:**

Leucocytosis, Leukopenia, Leukaemoid reaction, Myelodysplastic syndrome(MDS) .

**Leukaemias:** Definition ,Etiology ,Clinical features

**Classification:**

[ French American British- FAB classification] Lab Investigations Cytochemistry of Acute leukaemias

**Chronic myeloid leukaemia:**

clinical presentation. Investigations. Philadelphia chromosome.

Leucocyte Alkaline Phosphatase [LAP score.]Chronic lymphocytic leukaemia

**Plasma cell disorders:**

classification Plasma cell myeloma – definition ,clinical features, investigations.

**Myelo Proliferative disorders:**

general features ,classification – investigations

**Lympho Proliferative disorders:**

general features, classification , Investigations

Lipid Storage Disorders

Haemoparasites

Bone marrow examination

Section A: **PRACTICALS on Haematology** (25 hours)

Blood collection. Anticoagulants used in Hematology

Red cell indices

E.S.R., PCV, Platelet count, Absolute Eosinophil count

Reticulocyte count

Stains used in Hematology

Preparation of blood film

Preparation of Leishman's stain, Giemsa stain and MGG stain

Peripheral smear staining by leishman's stain. Interpretation of peripheral smear. Differential count.

Microcytic hypochromic anemia –

Investigations including serum Iron & TIBC

Macrocytic anemia - Investigations including B12 & folate assay, schilling test

Hemolytic anemia – General Lab investigations

Hemolytic anemia - Special Tests.

Osmotic fragility test

Alkali denaturation test

Sickling test

Hb electrophoresis

Investigations of G6PD deficiency

Autoimmune hemolytic anemia investigations

Coomb's test

Blood Parasites

Bone marrow – preparation of bone marrow smears , Trepine biopsy smears

Staining of B.M Aspiration Smears. Demonstration of Iron stain

Leukemia Interpretation of Peripheral smear in Leukemia.

Cytochemical stains –Demonstration

## **Section B CLINICAL PATHOLOGY & IMMUNOPATHOLOGY (25 hours)**

### **Clinical Pathology (10 hours)**

Collection, transport, preservation and processing of various clinical specimens

Urine examination, Physical, chemical and microscopic. Urine analysis by Strip method

Test for haemosiderin pigment.

Renal function tests.

Stool examination – collection of specimen of faeces

Macroscopic (Naked eye) inspection:

Concentration method ,Flotation method .

Microscopic examination

Chemical examination

Strip method:

Test for Occult blood – Benzidine Test Sputum examination – collection of specimen

Physical examination

Microscopic – Gram's stain, Ziehl Neelsen stain for AFB

Chemical examination

### **PRACTICAL on Clinical Pathology (10 Hours)**

Urine examination, Physical, chemical and microscopic. Urine examination by Strip method

Urine Test for haemosiderin pigment. [Demonstration ]

Stool examination –

i. Macroscopic examination

ii. Concentration method ,Flotation method .

iii. Microscopic examination

iv. Benzidine Test- for occult blood

Sputum examination - Macroscopic, Microscopic and AFB

Staining

### **IMMUNOPATHOLOGY (15 hours)**

Mechanism of Ab- mediated inactivation:

direct and indirect

Eg. Diabetes mellitus, thyroid diseases, pernicious anemia, polyendocrinopathy, infertility, haemophilia, myasthenia gravis, anti-idiotypes and diseases.

Immune deficiency disorders

Immunohaematologic diseases:

transfusion reactions, erythroblastosis foetals, warm-antibody diseases, cold antibody diseases, drug and hemolytic diseases, agranulocytosis, thrombocytopenic purpura, immune suppression cytotoxic antibodies in vitro.

Immune complex reactions:

Arthus reaction, serum sickness, evaluation of circulating immune complexes.

Atopic anaphylactic reactions:

Reagin antibody, anaphylaxis, atopic allergy – factors involved, asthma, hay fever, food allergy, insect allergy, atopic eczema, delayed hypersensitivity reactions, contact dermatitis, viral infections, graft-host relationship in pregnancy.

Autoallergic diseases:

Encephalomyelitis, multiple sclerosis, orchitis, thyroiditis, Sjögren's syndrome.

### **PRACTICAL on Immunopathology (15 HOURS)**

Serological tests [Screening & diagnostic] used in different pathological conditions.

Delayed type hypersensitivity testing

Detection of tumor markers.

Histocompatibility testing.

Blood grouping & cross matching.

Coomb's Test - Direct & Indirect.

Setting up of Immuno histochemistry lab.

### **SECOND SEMESTER**

#### **Haematology and Blood Transfusion –II**

Paper Title: Haematology, Clinical pathology and Medical Genetics (50 hours)

Section A Haematology (25 hours)

#### **Haemorrhagic disorders:**

Definition – Pathogenesis, Clinical feature, Classification. - vascular disorders, Platelet disorders, coagulation disorders, Fibrinolysis.

Normal haemostasis .

Investigation of haemorrhagic disorders

Tests of vascular and Platelet function – Bleeding time , Clot retraction, Platelet count

B.M Aspiration , Platelet Aggregation Studies.

Tests for Coagulation Disorders Screening test – First line tests

Prothrombin time (PT), Activated Partial Thromboplastin Time (APTT), Thrombin Time (TT)

Second line tests – Mixing experiments. Urea Solubility Test [Test for Factor XIII ]

Coagulation Factor assay. Factor VIII: C Inhibitor Study.

Disseminated Intravascular Coagulation [ DIC ] - Definition , Pathophysiology, Clinical Features and Laboratory Investigations.

Fibrinogen assay

**Thrombotic disorders:**

Classification, Pathogenesis, Clinical Features and Laboratory

Investigations. Antiphospholipid Syndrome.

Automation in Haematology

Organization & quality control in the laboratory

Cleaning of glassware

Biomedical waste management

**Section A: PRACTICAL on Haematology** (25 hours)

Haemorrhagic disorders

Collection and anticoagulants used – Demonstration

BT, CT – Demonstration

PT,INR, APTT, TT- Demonstration

Mixing experiments – Demonstration

Test for D-Dimers- Demonstration

Assay of coagulation factors - Demonstration

Factor VIII: C Inhibitor Study – Demonstration

Urea Solubility Test for Factor XIII- Demonstration

Fibrinogen assay - - Demonstration

Thrombotic work up - Demonstration

Investigation for Antiphospholipid Antibody- Demonstration

Automation in hematology - demonstration

Cleaning of glassware

Bio-medical waste management – demonstration.

Organization and quality control in the laboratory

Preparation of Stains, Reagents, Diluting fluids.

**Recommended Books** -Haematology and Clinical Pathology

1. Clinical Haematology illustrated - Colour Atls Victor Hoffbrand, John E Peth't

2. Parasitology - K.D.Chatterjee

3. Practical Haematology - 9th edition Dacie & Lewis

4. Haematology -6th edition - Williams

5. Wintrobe clinical haematology Vol- I - 10th edition

6. Wintrobe clinical haematology Vol- II -10th edition

7. Lynch's Medical Lab - Technology Latest edition

8. Clinical Diagnosis & Management - Todd & Sanford 19th edition 1996
9. Medical Laboratory Technology by Sood 5th edition, Jaypee Brothers 1999
10. Clinical Haematology in Medical Practice - G.C. Degruchy - 5th edition

## Section B **Clinical Pathology & Medical Genetics** (12 hours)

### **Clinical Pathology**

Gastric analysis:

Indications ,contra indication. Method of collection. Fasting gastric juice – Macroscopic and microscopic examination.

- i. Fractional test meal
  - ii. Augumented Histamin test
  - iii. Hollander's test
- Cerebrospinal fluid analysis  
Method of obtaining CSF, indications, contra indications.

Examination of CSF :

- i. Physical examinatio
- ii. Biochemical examination
- iii. Microscopic examination
  - a. Cytological examination
  - b. Bacteriological examination

Body fluids:

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

Pregnancy Test- Method ,interpretation.

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

### **PRACTICAL** on Clinical Pathology (12 hours)

Examination of Cerebrospinal fluid [CSF ] and body fluids.

Pregnancy Test

Examination of Semen.

### **MEDICAL GENETICS** (13 hours)

The history and impact of Genetics in Medicine

#### **Gregor mendel and the laws of inheritance:**

The chromosome basis of inheritance Origin of Medical Genetics Classification of Genetic disease The impact of Genetic disease Major new developments

The Chromosome varInternal Assesmenttion and sex determination An overview of chromosome number, chromosome composition and sex determination in humans.

Methods of chromosome analysis. Molecular cytogenetics. Chromosome abnormalities.

**Human genetic diseases:**

Genetic disorders with classical Mendelian inheritance. Autosomal recessive inheritance. Patterns of autosomal dominant inheritance. X-linked inheritance. Patterns of pseudo-autosomal inheritance. A typical pattern of inheritance.

Biochemical genetics:

**The inborn errors of metabolism.** Disorders of amino acid metabolism. Urea cycle disorders. Disorders of carbohydrate metabolisms. Disorders of steroid metabolism. Disorders of lipid metabolism. Lysosomal storage disorders. Disorders of urine /pyrimidine metabolism. Organic acid disorders. Disorders of copper metabolism. Peroxidase disorders.

**Human Genome project, treatment of genetic disease and gene therapy:**

Human genome project Treatment of genetic disease Gene therapy.

Genetics & society.

**PRACTICAL On Medical Genetics (13 hours )**

Study of Karyotypes I

Normal karyotyping in Humans – male (46, XY) and female (46, XX), G banded metaphase plates.

Study of Karyotypes II

Abnormal karyotypes – Down syndrome (Autosomal), Turner syndrome and Klinefelter syndrome (Sex chromosome)

Sex chromatin

Buccal smear study and staining methods for Barr bodies

Blood smear study of drumsticks in neutrophils

## SCHEME OF EXAMINATION OF PATHOLOGY

Theory: - Their shall be one paper of 3 hrs duration, carrying 100 marks each in semester

### PAPER I:-Pathology-I

#### Title: Haematology & Blood Transfusion

Sec A: - Haematology & Clinical Pathology

-50 marks

Sec B: - Immunopathology & Medical Genetics

-50 marks

Type of questions and distribution of marks for each section carrying 50 marks in theory subjects

Section A and section B			
Type of questions	No of questions	Marks	Total
Long Essay	01	20	20
Short Essay	05	06	30

### PRACTICAL EXAMINATION

**Max Marks: 70**

Experiments ( 40 marks) , Viva voce (30 marks) Spotters, Staining and reporting the Peripheral smear, Special test -(Any two to be performed ) RBC / WBC Count, reticulocyte count, Absolute Eosinophil Count, ESR or PCV, Osmotic Fragility Test, Sickling test,

Blood Transfusion preliminary tests

Blood grouping and typing including Dn test

(Compulsory ) Any one of the following,

Cross - Matching -Coomb's Test - Direct &

Indirect, Clinical Pathology a. Urine

Examination (Compulsory)

Physical, Microscopic, Chemical

Any two of the following

Sugar & Ketone Bodies, Protein & Blood,

Bilirubin / Bile salt / Bile pigment,

Stool Examination

Microscopic, Macroscopic, Special Tests

### VIVA-VOCE----30 Marks

The Viva Voce exam will carry 30 marks and both the internal and external examiners will conduct the examination

Note: each theory paper for 100 marks, Theory internal assessment 20 marks, viva voce 30 marks, practicals 40 marks, & practical internal assessment 10 marks. Thus each subject is for 200 marks

## **SUBSIDIARY SUBJECTS IN FIRST YEAR (I &II SEM) (40 hours)**

### **Syllabus For M.Sc MLT Subsidiary subject**

#### **Paper-1 Research methodology and biostatistics(100marks)**

##### **Section A Research Methodology 50 marks**

###### **Research hypothesis/Research question**

- What is a research question?
- Refining research question-SMART –Specific Measurable Attainable Relevant Time constraint
- PICO model-Definition of Population, Intervention, Comparison and Outcomes

###### **Review of literature**

- Need for Review of Literature
- Performing electronic literature search (Pubmed, EMBASE, Ind Med, Cochrane)
- Medical journals/text books
- Use of Boolean operators, keywords and filters
- Bibliography (reference writing styles)
- Systematic review and Meta-analysis

###### **Study designs for Biomedical Research**

- Pilot study
  - a. Observations(analytical-case control cohort, descriptive-cross sectional)
  - b. Experimental (Randomized clinical trials(RCT) and Non RCT) Preclinical studies, Clinical trials:
- Nuremberg code, Declaration of Helsinki, Belmont principles
- Phases of clinical trials (Blinding, Randomization)
- International Conference on Harmonization (ICH)-Good clinical practice (GCP), Good laboratory practice (GLP)

###### **Protocol writing & Informed consent from**

###### **References:**

1. Biomedical Research, Jagadeesh G, Sreekant Murthy, Gupta YK, Amitabh Prakash, Lippincott Williams & Wilkins 2010
2. Biostatistics: A foundation for analysis in health sciences. Wayne W Daniel. 2008
3. Basic Epidemiology. Bonita R, Beaglehole and Kjellstrom T, 2<sup>nd</sup> Edition. 2007
4. Ethical Guidelines for biomedical research on human subjects. ICMR New Delhi 2006
5. Statistical Methods in Medical Research, Armitage P, Berry G, Matthews JNS. 4<sup>th</sup> Edition.2001
6. Guidelines for use of Laboratory Animals in Medical Colleges, ICMR New Delhi 2001

## **SECTION B: BIO-STATISTICS**

### **Educational research, questionnaire design, reliability, validity**

#### **Sampling and sample size calculation**

- Different types of sampling (like cluster, stratified, purposive)
- Methods of estimating sample size
- Data-variables, scales

#### **Data Analysis:**

Choosing a statistical test-descriptive and inferential

- Parametric tests
- Non parametric tests
- Post hoc tests
- Correlation and Regression
- Data interpretation
- Use of SPSS and other statistical packages

#### **Research proposal writing/grant writing for extramural funds**

##### **Scientific communication**

- Paper presentation at conference
- How to write good scientific paper?
- Structure of scientific paper, Abstract, Title, Introduction, Methods, Results, Discussion (IMARD)

##### **Critical appraisal of article in journal**

##### **Thesis writing**

##### **Evidence Based Medicine**

##### **Ethical issues in research**

- Institutional Animal Ethics Committee
- Institutional Ethics Committee/Institutional Review Board
- Research Misconduct
- Plagiarism
- Authorship guidelines
- Conflict of interest
- Acknowledgement

## **References :**

1. Lwanga SK Cho-Yook Tye (Editors). Teaching Health Statistics, Twenty lessons and seminar outlines, World Health Organization, Geneva
2. Mahajan BK, Methods in Biostatistics for medical students and research workers. 6<sup>th</sup> Edition, Jaypee Brothers medical Publishers, New Delhi, 1997.
3. Sundr Rao PSS and Richard J. Introduction of Biostatistics; A Manual for students in Health sciences. Prentic-Hall of India Pvt. Ltd, New Delhi.
4. N.S.M. Rao : Elements of Health statistics

## **Assignments**

1. Collection and tabulation of data
2. Graphical representation of data
3. Correlation and regression analysis
4. Student's 't' test
5. Chi-square test
6. ANOVA

## **SECOND YEAR 3<sup>RD</sup> & 4<sup>TH</sup> SEMESTER SYLLABUS (BRANCH WISE)**

### **BRANCH: CLINICAL MICROBIOLOGY AND IMMUNOLOGY**

#### **4.1 SYLLABUS THIRD SEMESTER**

##### **Paper-I**

##### **Title: Systemic Bacteriology and Immunology (50 hours)**

(Section A Systemic Bacteriology & Section B Immunology)

##### **Systemic Bacteriology (25 HOURS)**

##### **Normal flora of the human body.**

Collection transport, processing of specimens of diagnosis of bacterial, viral and fungal infection in the following cases.

Respiratory tract infections, gastrointestinal tract infections, genital tract infections, CNS infections wounds and abscesses, eye, ear and sinus infections, infections of the blood, tissue samples for culture.

**Biological safety in clinical laboratory**, quality control, modern techniques employed in clinical laboratory.

##### **Nosocomial infections**

Epidemiology, bacterial and viral infections, infections in paediatric patients, surveillance and control programs, organizations and associations involved, role of microbiology lab in prevention and control, devices associated intravascular infections and its control, device associated intravascular infections and its control, sterilization, disinfections and antiseptics in hospitals.

##### **Respiratory tract infections**

Upper respiratory tract, etiology, transmission, pathogenesis, epidemiology and clinical features of following: Common cold, Pharyngitis and Tonsillitis, otitis and sinusitis, acute epiglottitis, oral cavity infections, laryngitis, and tracheitis, diphtheria. Lower respiratory tract- whooping cough, bronchitis, RSV infections, Bacterial diagnosis of respiratory tract infections.

##### **Urinary tract infections and sexually transmitted diseases**

Bacterial, viral and fungal infections of the urinary tract, etiology, pathogenesis,

transmission, clinical features and diagnosis of syphilis, gonorrhoea, Chlamydial infections, HIV, bacterial, Vaginosis, genital herpes, papiloma virus infections, opportunistic STDs.

### **Gastrointestinal tract infections:**

Etiology, pathogenesis, clinical features, and diagnosis of diarrhoeal diseases (bacterial and viral), H.pylori, food poisoning, parasites in the GI tract, systemic infections from GI tract.

## **IMMUNOLOGY**

History of immunology, innate and acquired immunity, mechanisms of innate immunity inflammation-inflammatory cells, mediators, inflammatory response types, antigens, cells and organs of immune system, evolution of immunity.

### **Immunoglobulin:**

Structure and function, classes and subclass- Cryoglobins, immunoglobulins genes – Organisation and expression, antibody diversity, class switching, monoclonal antibodies-hybridoma technique and MAB production, application in biomedical research, clinical diagnosis and treatment.

### **Immune Response:**

Clonal selection theory and related theories, primary and secondary response, humoral and cell mediated response, antigen processing and presentation, role of accessory molecules, MHC-structure and role in antigen presentation, MHC genes, maturation activation and differentiation of B cells and T cells, lymphocyte trafficking, TCR-structure and generation of diversity, cytokine properties and function, cytokine receptor, therapeutic uses, ADCC, NK cell regulation of immune response, advances in the development of vaccines (eg. Haemophilus B conjugate, Pertusis, Cholera, Malaria, Hepatitis B, Polio, HIV, Antitumour) adjuvants.

### **Compliment system:**

function, compliment receptors, activation pathways, control mechanisms, role in inflammation, kinin cascade, kinnins in disease.

## **PRACTICALS**

### **Systemic bacteriology and Immunology**

Double diffusion technique

Radial immuno diffusion

Haemagglutination inhibition test

Haemagglutination test

Latex agglutination test

Complement fixation test

## **Paper II Title: Virology & Mycology (50 hours)**

### **Virology**

Introduction .

History and principles of virology, virus taxonomy, Virus structures, animal and plant viruses- structure and morphology. viruses of veterinary importance and plant viruses.

Principles of bio-safety, containment facilities, maintenance and handling of laboratory animals and requirements of virological laboratory.

Microscopic techniques : Fluorescence, confocal and electron microscopic techniques -- principles and applications. Module 4: Analytical techniques. Electrophoresis, chromatography, membrane filtration, NMR, X-ray crystallography.

Virological methods:

Cultivation and purification of viruses. In vivo, in vitro and in ovo systems for virus growth, estimation of yields,

methods for purification of viruses with special emphasis on ultracentrifugation methods. Diagnostic methods . Immunodiagnosis, haemagglutination and haemagglutination-inhibition tests, Complement fixation, neutralization, Western blot, RIPA, flowcytometry and immunohistochemistry. Nucleic acid based diagnosis . Nucleic acid hybridization, polymerase chain reaction, microarray and nucleotide sequencing. Module

Systematic study of the following viruses: their biological properties, pathogenicity, epidemiology; isolation and identification from clinical specimens, lab diagnosis, treatment and immunoprophylaxis against parvoviruses, Adenoviruses, Herpes viruses, pox viruses, Hepatitis viruses, picorna viruses, Rota viruses, orthomyxoviruses

## **Mycology**

Mycology:

**Systematic study of the following Fungi:**

Epidemiology,

pathogenesis,

laboratory diagnosis, treatment and prophylaxis against superficial mycosis  
Pityriasis versicolor,

Tinea nigra,

Tinea piedra

Dermatophytes,

Subcutaneous mycosis Mycetoma,

Sporotrichosis,

chromoblastomycosis,

Rinosporidiosis, Lobomycosis,

Systemic Mycosis Histoplasmosis, blastomycosis, coccidiomycosis,

## **Practicals**

### **Section (A & B) Virology, and Mycology**

Common diagnostic tests detection of viral infections.

Identification of fungal pathogens in clinical specimens

Analytical methods: Protein estimation (Lowry), DNA estimation (colorimetric and spectrophotometric). Polyacrylamide gel electrophoresis, Confocal microscopy

Virus / Antigen detection : . ELISA test HIV & HBsAg

2. Immunofluorescence assay 3. Hemagglutination 4. Agar gel diffusion

5. Polymerase chain reaction 6. Electron microscopy

## **FOURTH SEMESTER**

### **BRANCH: CLINICAL MICROBIOLOGY AND IMMUNOLOGY**

#### **4.1 SYLLABUS**

#### **Microbiology-IV (Fourth semester)**

**Paper I title: Systemic Bacteriology & Immunology (50 hours)**  
(Section A systemic bacteriology section B immunology)

#### **Systemic Bacteriology (25 hours)**

##### **Central nervous system infections:**

meningitis caused by bacteria, viruses, fungi and protozoa, viral encephalitis, brain abscesses, tetanus, botulism.

Infections of the skin, ear and eye:

Etiology, transmission, diagnosis and prevention.

Microbiology of air, water and milk: common pathogens encountered, methods

Microbiological analysis, methods purification.

Identification of Non-fermenters- Pseudomonas, Acinetobacter, Stenotrophomonas

Commercial kit systems-API, Automated and semi-automated identification systems-

BACTEC, Vitek

##### **Quick screening methods:**

Chromogenic agar media Bacteriology of Milk, Water and Air

Molecular biology techniques for characterization of microbes and viral agents.

Bacteriological and viral serology.

## **Bacteriological and viral syndromes or diseases:**

Epidemiology, main clinical signs, basis for biological diagnosis, treatment.

- 1 Meninged syndrome.
- 2 Septicaemic syndrome.
- 3 Urinary and genital infections.
- 4 Bacteriological and viral diarrhoeas.
- 5 Respiratory infections.
- 6 Human acquired immunodeficiency syndrome.
- 7 Sexually transmitted diseases.
- 8 Hepatic virus infections.
- 9 Cytomegalovirus infections

## **Immunology (25 hours)**

### **Immunity against bacteria, Virus, Fungi and Parasites.**

#### **Immunological methods in clinical laboratories:**

Method interpretation and application of the following.

Double diffusion in agar Single radial immuno diffusion Electrophoresis and immunoelectrophoresis.

Chromatography, Ion exchange, Affinity (gel), RIA, ELISA, Western blotting.

Detection of immune complexes, nephelometry Immunofluorescence Agglutination test direct and indirect Haemagglutination and haemagglutination inhibition Complement assays-CFT Hemolytic assays Detection of cellular immunity-delayed hypersensitivity skin test Assays for lymphocytes-T and B cells Flow cytometry FACS Mixed lymphocyte culture NK cells neutrophil function test Histocompatibility testing

Auto Immunity

Transplantation Immunity

Tumor Immunity

## **PRACTICALS**

### **SYSTEMATIC BACTERIOLOGY**

Study of antibiotic sensitivity of common pathogens.

Study of microbial flora of air in various localities.

Microbial analysis of water.

Microbial analysis of milk.

Procedure of skin clipping for Leptrae bacilli.

Preservation of stock culture

Bacteriology of food

### **Immunology**

Immuno electrophoresis

Countercurrent immuno electrophoresis

FITC conjugation of antibodies

Lymphocyte culture

Isolation of lymphoid organs in mice

RIA demonstration

**FOURTH SEMESTER**  
**PAPER II - VIROLOGY & PARASITOLOGY (50 hours)**  
(section A: virology section B: parasitology)

**Virology (25 hours)**

**Viral Enteric Diseases and Cancers**

**Perspectives of Viral Diarrhoea**

Clinical course, disease burden, risk factors, epidemiology, prevention, and treatment. Rotavirus diversity, emerging strains, immunopathogenesis and vaccines under development. Other viruses associated with diarrhoea and gastroenteritis: Adenoviruses, astroviruses, Norwalk and Sapporo-like viruses and Enteroviruses Other enteroviral diseases.

**Viral Cancers**

Role of papilloma, HIV, Epstein Barr Virus, HTLV and herpes in pathogenesis of cancers, diagnosis, prevention.

**Viral Hepatitis**

1: Clinical presentation and epidemiology of viral hepatitis. Physiology of Jaundice, clinical features and differential diagnosis, presentations of hepatitis caused by different hepatitis viruses.

2: Structure & genomic organization Structure & genomic organization, replication, genotypes, serotypes of HAV, HBV, HCV & HEV. Mutations in hepatitis viruses.

3: Diagnostics Serological and molecular diagnosis of different hepatitis viruses.

4: Immunopathogenesis & animal models. Immunopathogenesis of different hepatitis viruses. Animal models and their uses.

5: Prevention & therapeutic approaches. Historical aspects, types of hepatitis vaccines, vaccines presently used & vaccines of the future. Vaccination as preventive measure in public health. Therapeutic possibilities of the present and future.

**Viral Respiratory Diseases**

1: Origin and evolution of viral respiratory diseases . History, clinical features, epidemiology, of influenza, RSV and other respiratory diseases.

2: Biology of respiratory viruses. Biology and pathogenesis of SARS, Metapneumovirus, human rhino virus and Corona virus etc.

3: Diagnostics Differential diagnosis of different respiratory diseases.

4: Vaccines Vaccines against different viral respiratory diseases.

### **Viral Exanthematous Diseases**

1 : Measles and SSPE Clinical features, disease burden, case definition and associated risk factor, strategies for prevention and treatment, biology and immunopathogenesis.

2: Rubella, CRS, mumps and Poxviruses Clinical features, disease burden of Rubella, CRS and mumps, case definition and risk factors. Preventive and therapeutic modalities. Pathogenesis of disease. .Clinical aspects of Parvovirus B –19.

3:Pox diseases Common features of viral pox diseases and case definitions. Paraspecific immunity due to pox vaccination, eradication and control programs.

### **Viral Haemorrhagic Fevers**

1: Clinical course of viral infections Common clinical features of Viral Haemorrhagic Fevers, History and Disease burden, Risk factors and geographical distribution of viruses associated with haemorrhagic fevers and their impact on global health. Clinical samples required, choice of laboratory diagnostic tests and their interpretation for differential diagnosis.

2: Dengue and DHF Virus replication strategy, Pathogenesis, Prevention and treatment of Dengue Role of humoral and cell mediated immunity and viral factors in development of DHF, differential diagnosis of DF and DHF on the basis of clinical symptoms.

3: Haemorrhagic manifestations caused by other viruses Virus replication strategy, Pathogenesis, Prevention and treatment of Yellow Fever, KFD, Chikungunya, Rift Valley Fever, Hanta, Marburg and Ebola, and Rickettsial fevers Development of killed KFD vaccine.

### **Viral Encephalitis**

1 Overview Viral Encephalitis, encephalopathy and meningitis clinical symptoms and causative agents, treatment modalities, Transmission, spread of the outbreak in relation to causative agent Laboratory diagnosis of viral encephalitic agents, basic principles, preferred methods and problems. 2 Japanese encephalitis and West Nile viral infections, endemic areas, disease burden, seasonality, role of non human hosts, genotypes vaccines Chandipura encephalitis, endemic areas, disease burden, seasonality, role of non human hosts, genotypes, other rhabdoviral neurotropic agents.

3 Other viruses Encephalitis/ encephalopathy caused by measles virus, Enteroviral encephalitis and meningitis, Causative agents, spread of the disease, seasonality, differential diagnosis, Mumps encephalitis, Encephalitis caused by alpha viruses Encephalitis caused by Nipah and hendra virus, Herpes virus encephalitis, diagnosis in sporadic cases, association with immunosuppression, reactivation vs primary infections, treatment

4 Pathogenesis Routes and modalities of infections of the nervous tissue, blood brain barrier, factors affecting the neurovirulence, Animal models and vaccine potency testing.

### **HIV/ AIDS**

1 Natural History of AIDS Global epidemiology of HIV, epidemiology of HIV in India. Sexually transmitted diseases and their relation with HIV, opportunistic infections in HIV infected individuals. Social and behavioural aspects of prevention and control. Natural history.

2 Biology of HIV and its detection Structure and replication of HIV, immunopathogenesis of infection, laboratory diagnosis of HIV infection. HIV isolation, characterization and viral estimation.

3 Preventive and therapeutic approaches Trials pertaining to prevention and therapy, Antiviral therapy and drug resistance HIV vaccines.

4: origin of HIV, HIV -2, SIV

### **References for viral enteric disease and cancer**

Recommended books:

1. Fields Virology, 4th Ed., Vol 2 Ed by David M Knipe, and Peter M Howley Chapters: 24, 28, 34, 54, 55, 67 and 68.
2. Gastroenteritis Viruses, Vol. 238. Novartis Foundation Symposium, Mary Estes, Latest edition /Pub. Date: June 2001.
3. Viral Infections of the Gastrointestinal Tract, Vol. 10. Albert Z. Kapikian, Z. Kapikian A. 2nd ed., rev. and expanded. Latest edition / Pub. Date: March 1994.
4. Human Enterovirus Infections, Harley A. Rotbart (Editor), American Society Microbiology, January, 1995.
5. Viral Gastroenteritis, Edited By U. Desselberger, J. Gray. Elsevier Perspectives In Medical Virology. Series Editor: Arie J. Zuckerman , Uk Isa K. Mushahwar. 2003.
6. Human Papilloma Viruses. Edited by D.J. McCance. Elsevier Perspectives In Medical Virology. Series Editor: Arie J. Zuckerman , Uk Isa K. Mushahwar. 2002.
7. Viruses and Liver Cancer. Edited by E. Tabor. Elsevier Perspectives In Medical Virology. Series Editor: Arie J. Zuckerman , Uk Isa K. Mushahwar. 2002.
8. Viruses, Cell Transformation, and Cancer. Edited by J.A. Grand. Elsevier Perspectives In Medical Virology. Series Editor: Arie J. Zuckerman , Uk Isa K. Mushahwar. 2001.

### **References for Viral hepatitis**

Recommended books:

1. Fields Virology, Volume 2, 4th edition:- (2001).
2. Clinical Virology, Second Edition (Richmans Hayden).
3. Hepatitis Viruses (Japan medical research fourm).
4. Viral Hepatitis and Liver disease, A.J. Zuckerman.
5. Viral Infection of Humans (S. Svans & A Kaslow).
6. Viral Hepatitis Molecular Biology Diagnosis and Control, By Isa Mushahwar. Elsevier Perspectives  
In Medical Virology. Series Editor:Arie J. Zuckerman , Uk Isa K. Mushahwar.2003.

### **References for respiratory disease**

Recommended books:

1. Viral Infections of Respiratory Tract by Raphael Dolin and Peter Wright. Mercel Dekker.
2. Clinical Virology Manual Ed: Specter, RL Hodinka, SA Young. ASM Press.
3. Influenza. Edited by C.W. Potter. Elsevier Perspectives In Medical Virology. Series Editor:Arie J. Zuckerman , Uk Isa K. Mushahwar. 2002.

### **References for exanthematous disease**

Recomended books:

1. Krugman's Infectious Diseases of children By Saul Krugman.
2. Immunization Safety Review: Vaccines and Autism Immunization Safety Review Committee (Editor) The National Academies Press, USA.
3. Measles and Rubella. Alvin Silverstein, Robert Silverstein, Virginia B. Silverstein, Virginia Silverstein. July 1997.
4. Immunization Safety Review: Measles-Mumps-Rubella Vaccine and Autism. Kathleen R. Stratton, Alicia R. Gable, Padma Shetty. June 2001

### **References for viral hemorrhagic fever**

Recommended books:

1. CRC Handbook of Viral and Rickettsial Hemorrhagic Feverby James H. S. Gear.
2. Viral Haemorrhagic Fevers. By C.R. Howard. Elsevier. Perspectives In Medical Virology. Series Editor:Arie J. Zuckerman , Uk Isa K. Mushahwar. 2004.
3. Dengue and Dengue Hemorrhagic Fever, D. J. Gubler (Editor), G. Kuno (Editor), Latest edition / Pub. Date: January 1998.
4. Bioterrorism Hemorrhagic Viruses Manual: For Healthcare Workers and Public Latest edition / Pub. Date: April 2004.

### **References for viral encephalitis**

Recommended books:

1. Viral Encephalitis in Humans. John Booss (Editor), Margaret M. Esin, Margaret Esiri (Editor). Latest edition / Pub. Date: June 2003. Publisher: ASM Press.
2. Encephalitis Protection. Qingshan Liang. Latest edition / Pub. Date: January 2004. Publisher: Cozy Graphics Corporation.

## **Parasitology (25 hours)**

Study of morphology,  
important developmental stages,  
symptoms,  
pathogenesis,  
epidemiology,  
diagnosis,  
treatment,  
prevention of following parasites.  
TaeniaEchinococcus,  
Schistostoma,  
Paragonimus,  
Diphyllobothrium,  
Ascaris,  
Enterobius,  
Ancylostoma,  
trichura,  
Wuchereria,  
Dracunculus,  
Trichinella spiralis.

## **PRACTICAL**

### **Parasitology**

Diagnostic tests for detection of parasitic infections-  
methods for demonstration of  
parasites in clinical specimens  
Preparation of blood smear for detection of filarial parasites.