

**JAWAHARLAL INSTITUTE OF POSTGRADUATE  
MEDICAL EDUCATION & RESEARCH  
(JIPMER)  
PUDUCHERRY**



**MSc MLT MICROBIOLOGY  
CURRICULUM**

**2021**

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## **JIPMER**

Jawaharlal Institute of Postgraduate Medical Education and Research, Puducherry (JIPMER) under Government of India since the year 1956, is one of the leading Medical Institutions of India. Spread over a sprawling 195-acre campus in an urban locale of Puducherry (formerly Pondicherry), JIPMER is 170 kms by road from Chennai.

JIPMER has been declared as an “Institution of National Importance” by an Act of Parliament, JIPMER, Puducherry, Act, 2008. A copy of the Act was Gazette notified on 14-7-2008 to enforce this Act. Prior to this, the Institute was functioning under the administrative control of Directorate General of Health Services, Ministry of Health and Family Welfare, New Delhi. The Institution is now empowered to award Medical Degrees under the clauses 23 & 24 of the said Act. Such Degrees shall be deemed to be included in the schedules to the respective Acts governing Medical Council of India/National Medical Commission, Indian Nursing Council, and Dental Council of India, entitling the holders to the same privileges as those attached to the equivalent awards from the recognized Universities of India.

JIPMER imparts Undergraduate (UG), Postgraduate (PG) and Super Specialty Medical Training through a large hospital complex (JIPMER Hospital) and a Nursing College. Some of the courses offered are MBBS., BSc., MSc., MD., MS, DM., and MCh. Courses. Full-time Ph.D. Programs are available in several disciplines.

### **DEPARTMENT OF MICROBIOLOGY**

The Department of Microbiology has three primary responsibilities such as teaching/training, diagnostic laboratory services and research activities. The department is actively involved in teaching undergraduates and postgraduates. Training and educational events are organized in the form of workshops and CMEs in diverse topics such as HIV and opportunistic infections, clinical diagnostic methods, parasitic infections and tuberculosis.

The Microbiology laboratory provides a gamut of advanced and novel diagnostic tests. It offers quality diagnostic services to the various clinical departments. Tests that have been added in the recent years to the meet the diagnostic needs of the hospital include MALDI-TOF MS for bacterial and yeast identification, PCR for HIV, HSV and *E. histolytica*, NS1 antigen detection, stool culture for *Campylobacter jejuni*, antigen detection tests for filariasis. The department has started viral load testing for Hepatitis B and C along with PCR based diagnosis for Cytomegalovirus, Japanese encephalitis, West Nile Virus & Zika virus.

The department offers high end diagnostic facilities like high throughput automated ELISA system (EVOLIS ELISA system) which can run four assays at any given time, real time PCR and molecular tests for diagnosis of amoebiasis, tuberculosis & HSV. It also has

facilities for automated detection and antimicrobial susceptibility testing by VITEK 2, MGIT and GeneXpert IV. The department has also introduced GeneXpert as routine diagnostic test for diagnosis of TB and detection of rifampicin resistance in extrapulmonary TB, pediatric TB and HIV associated TB. Besides these, it has also introduced the PARASIGHT for rapid and quick diagnosis of malarial parasite and also to quantify the load.

The Department houses the State Reference Laboratory for HIV testing which is accredited by National Accreditation Board for Testing and Calibration Laboratories (NABL), Regional Influenza Laboratory and ICMR funded Regional level Virology Laboratory. It is the ICMR nodal Center for antimicrobial resistance surveillance in Staphylococci and Enterococci. The department is making an all round effort to provide newer diagnostic services for better patient care, upgraded training program for the students: both undergraduates and postgraduates, and a congenial environment for research and innovation.

## **2. Course details:**

### **2.1 Nomenclature of the course:**

MSc MLT Microbiology

### **2.2 Introduction:**

Scientific and technological advancements have created complexity in the diagnostic field necessitating advanced educational preparation. To keep pace with the tremendous progress in Medical Science and to meet changing health care needs, specialization and research are essential in the field of Laboratory science. Post Graduate programme in Medical Laboratory Technology MSc MLT (Microbiology) gives opportunity for specialized study in the field of Medical Laboratory Technology for BSc (MLT)/Bachelor of medical laboratory sciences (BMLS) graduates.

The specialization in the laboratory technology in the field of microbiology requires an advanced knowledge of bacteriology, immunology, virology, parasitology, mycology, molecular biology and instrumentation.

### **2.3 Objectives:**

The students of MSc MLT (Microbiology) at the end of their two-year course should be able to

1. Establish functioning Microbiology laboratory in the hospital and community in the field of Bacteriology, Virology, Parasitology, Immunology and Mycology.
2. Impart the basic knowledge and skill in diagnostic Microbiology to students through various teaching learning activities.
3. Learn the use, maintenance and calibration of equipment commonly used in a clinical Microbiology laboratory (eg. incubators, centrifuge, vortex etc.).
4. Understand the working principle, use and troubleshoot advanced and automated systems used in Microbiology laboratory (eg. MALDI TOF MS, Vitek, mini VIDAS etc.).
5. Perform various microbiologic investigations on various samples in assessment of disease conditions.
6. Collect relevant information regarding the existing knowledge of Microbiology, in general, and in his/her field of interest by utilizing library and other sources of information.

7. Identify the lacunae in the existing knowledge of Microbiology and design and execute appropriate experiments to investigate a relevant problem.
8. Analyse the results of investigation and draw valid conclusions therefrom.
9. Utilise appropriate bio-statistical knowledge and methods to evaluate the results of investigations.
10. Present the research findings in proper and scientific format in writing or in appropriate scientific fora.
11. Impart theoretical and practical knowledge to B.Sc. MLT/BMLS students through lectures and practical demonstrations.
12. Improve knowledge, attitude, and skill by self-learning on completion of formal training.
13. Demonstrate understanding of principles of personnel management for smooth working with other members in the department.
14. Plan, execute and analyse applied and fundamental research in various branches of Microbiology involving other related disciplines for health care.

### 3. Regulations:

#### 3.1 Eligibility:

Only Indian citizens are eligible for admission to the course. A regular BSc MLT (Medical Laboratory Technology)/Bachelor of Medical laboratory sciences (BMLS) degree from a University/Institute, recognized by JIPMER, with minimum of (50%) marks for all the years of BSc (MLT) examination taken together.

#### 3.2 Method of Selection:

Candidates applying for the MSc MLT (Microbiology) course will be selected based on merit in the common All India Entrance examination conducted by the by the institute. The syllabus for the entrance examination will be of BSc MLT/BMLS standard.

#### 3.3 Candidates intake per year:

Five candidates will be admitted to the course every year. There is no provision for sponsored / nominated candidates.

#### 3.4 Duration of the course

2 years (24 months) duration including the completion of project from the date of joining irrespective of the date of exit exam.

#### 3.5 Medium of instruction:

English

#### 3.6 Vacation

As per institute guidelines, students will be eligible for 15 days' vacation in summer and 9 days in winter.

#### 3.7 Subject details:

Year	Paper	Title of the paper
<b>I year</b>	I	General Microbiology, Immunology, and basics of molecular biology
	II	Systematic bacteriology
	III	Virology
<b>II year</b>	I	Parasitology
	II	Mycology & Animal experiments
	III	Applied, advanced molecular biology and instrumentation

### 3.8 Training pattern: Theory, Practical and hands-on work in the laboratory including emergency laboratory services

During a period of two years, theoretical and practical training will be imparted to the candidates as follows.

#### Cognitive

1. Attending lectures: one lecture (followed by discussion) of 1hour duration weekly.
- 2 Seminar (technique/culture) followed by discussion of 1h duration weekly.

#### Presentation skill

Technique/culture seminars: MSc trainees present technique/culture seminars under the moderation of a Faculty Member. In two years, each trainee presents a minimum of 6 seminars (at least one seminar in each of five subspecialties, viz bacteriology, immunology, mycology, virology, parasitology and molecular biology).

#### Practical training:

An MSc trainee will be posted to work in rotation in various sub-specialties in the departments of Medical Microbiology and will actively participate in routine diagnostic and research activities of the laboratories daily during the working hours (40 hours a week). They will also be put on Emergency Microbiology duties to train them in independent processing of clinical specimens received in the emergency laboratory.

The following is the breakup of the two-year posting of an MSc trainee for practical training:

#### Msc MLT First Year Section Posting (one year duration):

Bacteriology (aerobic & anaerobic) and Basics of molecular biology	6 months (5+1 months)
Immunology, Mycobacteriology	3 months
Hospital Infection, Water analysis	1 month
Virology	2 months

#### Msc MLT Second Year Section Posting (one year duration):

Parasitology& Animal experiments	3 months
Mycology	3 months
Advanced molecular biology& Instrumentation	6 months*

\*2 months –Virology (Real time PCR, conventional PCR), 2 months-Mycobacteriology (GeneXpert, real time PCR), 2 months-Instrumentation (MALDI-TOF MS, Vitek, MGIT, autoclave etc)-posting for 1 month in blood culture & 1 month in Mycobacteriology.



# **SYLLABUS**

## **FIRST YEAR:**

### **Paper I - General Microbiology, Immunology, and basics of molecular biology**

#### **General Microbiology - Theory**

1. History of Microbiology.
2. Microscopy
3. Biosafety including universal precautions.
4. Sterilization and disinfection.
5. Morphology of bacteria.
6. Nomenclature and classification of bacteria.
7. Normal flora of human body.
8. Growth and nutrition of bacteria.
9. Bacterial metabolism.
10. Bacterial toxins: general properties.
11. Bacteriocins.
12. Antibiotics and chemotherapeutic agents: basic concepts and mechanisms of action.
13. Physical and biological containment.
14. Principles of antimicrobial susceptibility testing.
15. Microbiology of air, milk, and water.
16. Microbiology of hospital environment.
17. Management of infectious waste.
18. Methods of surveillance of hospital acquired infections.
19. Investigation of an infectious outbreak and methods of infectious disease surveillance.
20. Bacterial and bacteriophage genetics: basic principles and mechanisms of genetic variations, mutation, recombination, transposition, etc.
21. Quality assurance in microbiology.
22. Accreditation of laboratories.
23. Testing of disinfectants

## **General Microbiology - Practical training**

1. Aseptic practices in laboratory and universal safety precautions including use of biosafety hoods.
2. Use, care and maintenance of microscope and micrometry
3. Operation of autoclave, hot air oven, distillation plant, membrane filters assemblies.
4. Washing and sterilization of glassware.
5. Disposal of infectious laboratory waste.
6. Estimation of minimum inhibitory / bactericidal concentration
7. Minimum Inhibitory Concentration (MIC) determination by E test.
8. Bacteriological tests in water, air, and milk
9. Methods of disinfectant testing

## **Immunology - Theory**

1. Components of the immune system
2. Innate and acquired immunity
3. Antigens
4. Immunoglobulins
5. Antigen and antibody reactions: agglutination, precipitation
6. Cells involved in immune system
7. Complement
8. Cell-mediated immunity
9. Hypersensitivity reactions
10. Cytokines
11. Immunoassays including immunofluorescence, immunohistochemistry, ELISA, ELFA, chemiluminescence
12. Vaccinology: principle, methods of preparation

## **Immunology - Practical training**

1. Collection and transport of blood specimens, separation of serum, preservation of serum for short and long periods.
2. Preparation of buffers: phosphate, tris buffer and buffers of different pH and molarity
3. Performance of serological tests viz VDRL (including antigen preparation) tests.
4. Latex agglutination test for C-reactive protein, Rheumatoid factor, ASO.
5. Performance of serological tests viz standard tube agglutination for Brucella, Widal.
6. Serology of leptospirosis including ELISA and IgM dipstick.
7. Confirmatory tests for syphilis (TPHA)
8. Immunoblotting

## **Basics of Molecular Biology (Theory & Practical)**

1. Nucleic acid extraction methods
2. Conventional PCR
3. Multiplex PCR
4. Nested PCR

## Paper II - Systematic bacteriology

### Theory

1. Isolation and identification of bacteria.
2. Gram positive cocci of medical importance including *Staphylococcus*, *Micrococcus*, *Streptococcus*, *Enterococcus*, etc
3. Mycobacteria: general characters and classification.
4. Gram negative cocci of medical importance including *Neisseria*, *Moraxella*, *Veillonella*, etc.
5. Gram positive bacilli of medical importance including *Lactobacillus*, coryneform organisms, *Gardnerella*, *Bacillus*, *Actinomyces*, *Nocardia*, *Actinobacillus* and other *Actinomycetales*, *Propionibacterium*, *Bifidobacterium*, *Eubacterium*, *Erysipelothrix*, *Listeria*, *Clostridium* and other spore-bearing anaerobic bacilli.
6. Gram negative bacilli of medical importance including *Enterobacteriaceae*, *Vibrio*, *Aeromonas*, *Plesiomonas*, *Haemophilus*, *Bordetella*, *Brucella*, *Pasteurella*, *Francisella*, *Legionella*, *Pseudomonas*, *Burkholderia*, *Acinetobacter* and other non-fermenters, *Bacteroides*, *Fusobacterium*, *Prevotella*, *Porphyromonas* and other anaerobic Gram negative bacilli, *Helicobacter*, *Campylobacter*, *Spirochaetes*, *Mycoplasma*, *Chlamydiae*, *Rickettsiae*, *Bartonella*, *Coxiella*, etc.

Knowledge of the above family/genus/species should include definition, historical perspectives, classification, morphology, cultural characteristics, metabolism, genetics, molecular and antigenic structure, laboratory isolation and identification, tests for virulence and pathogenicity, susceptibility, methods of prevention including vaccines and recent developments.

### Practical training

1. Preparation and standardization of bacteriological loop.
2. Preparation of media like nutrient agar, blood agar, MacConkey agar, LJ medium, Robertson's cooked meat medium, routinely used biochemical test media and reagents.
3. Preparation of special media for specific bacterial pathogens.
4. Collection and transport of specimens for bacteriological investigations.
5. Identification of bacteria of medical importance up to species level-Gram positive cocci and *Enterobacteriaceae*.
6. Techniques of anaerobiosis.
7. Preparation of stains viz Gram, Albert, capsule stain, acid fast stains.

8. Preparation, examination, and interpretation of direct smears (from clinical specimens) for bacterial infections.
9. Quantitative/ semi-quantitative analysis of urine by standard loop technique and pour plate technique to detect significant bacteriuria.
10. Processing of clinical specimens for bacteriological isolation, purification, identification, and quantification purposes.
11. Tests for motility of bacteria, hanging drop, Cragie's tube, and semisolid agar.
12. Quality control of media and reagents.
13. Performance of antibacterial susceptibility testing.
14. Maintenance and preservation of bacterial cultures.
15. Special staining techniques including spore staining, flagellar staining etc.

## **Paper III - Virology**

### **Theory**

1. The nature of viruses, classification of viruses, morphology: virus structure, virus replication, the genetics of viruses
2. Bacteriophages
3. Isolation and identification of viruses
4. Epidemiology of viral infections, the pathogenicity of viruses, vaccines, and anti-viral drugs
5. Viruses of medical importance-Pox viruses, Herpes viruses, Vesicular viruses, Togaviridae, Bunyaviridae, Arenaviridae, Marburg and Ebola viruses, Rubella virus Influenza virus, Rhinoviruses, Adenoviruses, Corona viruses
6. Paramyxoviridae, Enteroviruses: polio, ECHO, Coxsackie viruses, Other enteric viruses, Hepatitis viruses, Rabies virus, Slow viruses, Human immunodeficiency viruses, Oncogenic viruses and viruses causing gastroenteritis.

Knowledge of the above family/ genus/ species should include definition, historical perspectives, classification, morphology, cytopathic effect, genetics, molecular and antigenic structure, laboratory isolation and identification, methods of prevention including vaccines and recent developments.

### **Practical training**

1. Perform routine diagnostic ELISA for viral diseases
2. Immunofluorescence (IF), immunochromatography test (ICT) etc.
3. ELFA, chemiluminescence

### Scheme of Assessment for MSc MLT Microbiology I year:

	<b>Maximum marks</b>
Theory examination	240
Practical and Viva voce examinations (240+20)	260
Internal assessment	100
<b>Grand total</b>	<b>600</b>

#### Theory examination:

	<b>Theory papers*</b>	<b>Maximum marks</b>
Paper I	General Microbiology, Immunology, and basics of molecular biology	80
Paper II	Systematic bacteriology	80
Paper III	Virology	80
<b>Total marks</b>		<b>240</b>

\*Mark distribution for theory paper will be 8 questions of 10 marks each. Each theory paper will be for a duration of three hours

#### Practical examinations and viva-voce examinations (Two days):

<b>Practical</b>	<b>Maximum marks</b>
Immunology	80
Bacteriology	80
Virology	80
Viva-voce	20
<b>Total marks</b>	<b>260</b>

## SECOND YEAR:

### Paper I – Parasitology

#### Theory

- 1. Isolation and identification of Protozoa.**
- 2. Protozoal infections:** Protozoa of medical importance-Intestinal Amoeba (*Entamoeba histolytica*, Other intestinal amoeba), pathogenic Free-living amoeba (*Naegleria fowleri*, *Acanthamoeba* species), intestinal, oral and genital flagellates (*Giardia intestinalis*, *Trichomonas vaginalis*, other flagellates), blood and tissue flagellates (*Leishmania donovani*, *Leishmania tropica* complex, *Leishmania braziliensis* complex, *Leishmania mexicana* complex, *Trypanosoma cruzi*, *Trypanosoma brucei* complex), malaria parasites and piroplasms (*Plasmodium falciparum*, *Plasmodium vivax*, *Plasmodium malariae*, *Plasmodium ovale*, Babesia species), coccidia (*Toxoplasma gondii*, *Cryptosporidium*, *Cystoisospora belli*, *Blastocystis hominis*).
- 3. Helminthic infections:** Introduction to Helminths. Helminths of medical importance- Cestodes (*Diphyllobothrium latum*, Taenia species, Echinococcus species, Hymenolepis species), Trematodes: (Schistosoma species, Fasciola species, *Fasciolopsis buskii*, Paragonimus species, *Clonorchis sinensis*, Other trematodes), Nematodes (*Trichinella spiralis*, *Trichuris trichiura*, Strongyloides species, Ancylostoma species, Necator species, *Enterobius vermicularis*, Ascaris species, Larva migrans, *Wuchereria bancrofti* and other species, *Brugia malayi* and other species, *Dracunculus medinensis*).
- 4. Ectoparasites:** Common arthropods and other vectors viz. mosquito, sand fly, ticks, mite, cyclops.

Knowledge of the above family/ genus/ species should include definition, historical perspectives, classification, morphology, cultural characteristics, genetics, molecular and antigenic structure, laboratory isolation and identification, virulence and pathogenicity tests, methods of prevention including vaccines and recent developments.

#### Practical training:

1. Examination of faeces for parasitic ova and cysts etc. by microscopy, concentration methods and culture
2. Examination of blood for parasites by microscopy, stains- Leishman, Giemsa, etc.
3. Examination of other specimens e.g., urine, CSF, bone marrow, corneal scraping etc. for parasites
4. Performance of semi-automated tests such as Quantitative buffy coat (QBC), etc.
5. Multiplex PCR for differentiation of *Entamoeba spp.*



## **Paper II – Mycology & Animal experiments**

### **Mycology-Theory**

1. General properties, morphology and classification of fungi.
2. Fungi causing superficial infections
3. Fungi causing subcutaneous infections
4. Fungi causing systemic infections
5. Fungi causing opportunistic infections
6. Mycotoxins
7. Principles of in-vitro antifungal susceptibility tests.

Knowledge of the above family/ genus/ species should include definition, historical perspectives, classification, morphology, cultural characteristics, metabolism, genetics, molecular and antigenic structure, laboratory isolation and identification, virulence and pathogenicity tests, susceptibility tests, methods of prevention including vaccines and recent developments.

### **Mycology - Practical training:**

1. Collection, transport, and processing of specimens for microscopy and culture for diagnosis of superficial, subcutaneous and systemic fungal infections.
2. Direct examination of specimens by KOH, Gram's, India ink, Giemsa, and special fungal stains like GMS.
3. Isolation and identification of medically important fungi causing superficial and subcutaneous infections.
4. Special techniques like slide culture.
5. *Candida*, *Cryptococcus*, *Malassezia*, *Trichosporon*, *Geotrichum*, *Aspergillus*, *Zygomycetes*, *Fusarium*, *Coccidioides*, *Sporothrix*, *Penicillium marneffeii*, *Dermatophytes*, *Actinomycetes*, *Nocardia*, *Paecilomyces*, *Curvularia*, *Bipolaris*.
6. Maintenance of stock cultures.
7. Calcofluor staining and examination under fluorescent microscope.
8. Special techniques like Wood's lamp examination, hair baiting and perforation.
9. Antigen detection in Cryptococcosis, Aspergillosis.
10. Immunofluorescence for *Pneumocystis jirovecii*
11. Beta D glucan assay for the diagnosis of invasive fungal infections

### **Animal experiments – Theory**

1. Handling and uses of the animals in Microbiology laboratory-Rabbit, sheep, mice and guinea pig
2. Alternate models used in experimental and diagnostic Microbiology

## **Paper III – Applied, advanced molecular biology and instrumentation**

### **Advanced Molecular Biology**

1. Designing of primers
2. Real Time PCR
3. 16s RNA sequencing
4. NGS (next generation sequencing)

### **Instrumentation - include the working and applications of**

1. Autoclave
2. Hot air oven
3. Biosafety cabinets
4. Centrifuge/ Vortex/ Water bath
5. Calibration of Pipettes
6. Incubator/ BOD
7. ELISA
8. MALDI TOF MS
9. Vitek 2
10. BacT/ALERT
11. BACTEC
12. Anoxomat
13. mini VIDAS (ELFA)
14. Chemiluminescence
15. GeneXpert
16. MGIT
17. Fluorescence microscopy
18. Confocal microscope

## **Modules on Molecular Biology and Biostatistics: (included only in formative assessment)**

Six classes each for biostatistics and six classes each for molecular biology will be held in the second year. These will be conducted for both students of MSc MLT Microbiology and Pathology together at the same time in the same class.

### **Molecular biology**

1. Essentials of molecular laboratory
2. Nucleic acid extraction methods
3. Probes and designing of primers
4. PCR – Conventional, Multiplex, Nested, Real Time
5. 16s RNA sequencing
6. Next generation sequencing (NGS)
7. Quality control in molecular laboratory

### **Biostatistics**

1. Data and variables: Types of data, tabulation of data
2. Measures of central tendency, measures of dispersion and location
3. Probability: Concepts, laws of probability and probability distribution
4. Sampling, Sampling variability and significance
5. Designing and analysis of lab experiments
6. Correlation and regression analysis concepts
7. Evaluation of diagnostic procedure – Sensitivity, Specificity, Predictive values, Likelihood ratio and ROC curve
8. Testing of hypothesis – concept of hypothesis and statistical significance, Parametric and non-parametric tests.

**Textbooks Recommended (Latest edition):**

- Parija SC. Textbook of Medical Parasitology. 3rd ed. New Delhi India: All India Publishers and Distributors.
- Chander J. Textbook Of Medical Mycology. New Delhi India: Mehta Publishers.
- Ananthanarayan R, Paniker C. Textbook of Microbiology. India: Orient Longman
- Parija S C. Textbook of Microbiology. India. Elsevier.
- Brooks GF, Jawetz E, Melnick JL, Adelberg EA. Jawetz, Melnick, & Adelberg's medical microbiology. New York: McGraw Hill Medical.
- Murray PR, Baron EJ, Pfaller MA, Tenoer PC, and Tenover RH. Manual of Clinical Microbiology. Washington, DC: American Society for Microbiology.
- Mandell GL, Bennett JE, Dolin R. Principles and Practice of Infectious Diseases. New York: Churchill Livingstone.
- Gransden WR. Topley & Wilson's Microbiology and Microbial Infections. Hodder Arnold.
- Sambrook J, Russel D. Molecular Cloning: A Laboratory Manual. New York. Cold Spring Harbour Laboratory Press.
- Buckingham L, Maribeth L. Molecular Diagnostics: Fundamentals, Methods, & Clinical Applications. F.A. Davis Company, Philadelphia.
- Delves P J, Roitt IM. Essentials Immunology. Blackwell Science.
- Stites, Daniel P, & Terr, Abba I. Medical Immunology. Mc Graw Hill.
- Sastry AS, Bhat S. Essentials of medical microbiology. Jaypee Brothers, Medical Publishers Pvt. Limited.
- Sastry AS, Bhat S. Essentials of medical parasitology. Jaypee Brothers, Medical Publishers Pvt. Limited.

**Books for Practical Training (latest edition):**

- Mackie TJ, Collee JG. McCartney JE. Mackie & McCartney practical medical microbiology. New York Churchill Livingstone.
- Parija SC. Textbook of Practical Microbiology. Ahuja Publishing House, New Delhi,
- Forbes B.A., Sahm D.F., Weissfeld A.S. , Bailey W.R. Bailey & Scott's Diagnostic Microbiology. Elsevier Mosby, St. Louis.
- Koneman EW, Allen SD, Schreckenber PC, Winn WC: Colour Atlas and Textbook of Diagnostic Microbiology. JB Lippincott, Philadelphia.

### Scheme of Assessment for MSc MLT Microbiology II year:

	<b>Maximum marks</b>
Theory examination	240
Practical, Viva-voce examinations and project (220+20+20)	260
Internal assessment	100
<b>Grand total</b>	<b>600</b>

#### Theory examination:

	<b>Theory papers</b>	<b>Maximum marks</b>
Paper I	Parasitology	80
Paper II	Mycology & Animal experiments	80
Paper III	Applied, advanced molecular biology and instrumentation	80
	<b>Total marks</b>	<b>240</b>

#### Practical examinations and viva-voce examinations (Two days):

<b>Practical</b>	<b>Maximum marks</b>
Parasitology	80
Mycology	80
Molecular biology and instrumentation	60
Project work presentation, and viva-voce	20
Viva-voce examination	20
<b>Total marks</b>	<b>260</b>

## Regulations of MSc MLT Microbiology course:

### Attendance:

- Students are required to attend 75% or more of all theory classes held, and 75% or more of practical/lab postings in each subject to be eligible to appear in the annual examination. Under no condition will a student with less than the prescribed attendance in any subject be allowed to appear in the annual examination of that subject.
- Students with less than 75% attendance in theory and/or practical/lab postings at the end of any year must start afresh in those subjects by joining the junior batch of students. No extra classes will be arranged to make such students eligible for the annual examinations. The attendance accrued in the previous academic year in those subject(s) will not be transferred. Students will be required to secure 75% attendance afresh in theory and practical/clinical of subjects detained, after joining the junior batch to become eligible to appear in the annual examination.
- The 25% leverage in attendance includes all types of leaves (including leave on medical grounds). For absence because of illness or any medical condition, a duly approved medical leave from Dean (Academic) with medical and fitness certificate issued/verified by authorized JIPMER clinical faculty member is mandatory. Certificate must be submitted before or within 10 days after availing medical leave.
- Attendance cannot be improved upon by attending classes during the gap between the annual regular examination and supplementary examination held within 6 weeks of the former.
- Students who are detained in all the subjects of a year due to lack of attendance should join the classes with junior batch within 7 days of declaration of the eligibility/detention list or when classes commence, whichever is earlier.
- Students who are detained in one or more subject(s) because of lack of attendance but are eligible to appear for annual examination in at least one subject of the year should join classes with junior batch within 7 days of completion of the last final theory/practical examination or when classes start, whichever is earlier. Attendance accrued in the previous academic year will lapse and attendance will be calculated afresh from the date of joining the junior batch.
- A show-cause notice will be issued to students on continuous unauthorized absence without prior permission for two weeks or more. If such absence extends to a period more than one month for any reason, the student is liable for termination from the course. The decision of the competent authority is final.
- There is **no condonation permissible** for shortage of attendance.

## **Internal Assessment (IA):**

Comprehensive assessments will be done throughout the course. A minimum of three notified internal assessments (including model examination) will be held for a subject paper periodically in each year before the final annual examination and the candidate will be examined in theory and practical. Each notified test and the model examination will carry equal weightage for calculation of final internal assessment marks. The internal assessment marks will form 20% of the summative assessment. However, there is no minimum cut-off percentage of internal assessment mandatory to become eligible to appear in the annual examination.

## **Project:**

1. Submission of project work is mandatory for the appearing in the final examination. The project work shall be carried out by the candidate under the guidance of a postgraduate teacher in the department. No change in the project work topic/Guide shall be made without prior approval from the Institute. The topics for the project shall be selected within the first three months of the course and complete the project work, after approval of Departmental postgraduate monitoring committee and Institute Ethics committee, as per institute guidelines. The final project shall be submitted three months before the final examination. The project work is mainly to orient the candidate towards research methodology. Collaboration works with other departments are encouraged.
2. The project will be sent for review by an external faculty and will be evaluated by the External/Internal Examiners at the time of viva voce examination of the candidate during the final summative exam. 20 marks will be allotted for the quality of work and defending of the project by the candidate.
3. The final project duly approved by the external/ Internal Examiners will be submitted to the Dean's office along with the result. The Dean's office will send the project to the library for record.

## **Logbook:**

All the candidates shall maintain a Logbook for recording performance of activities, seminars, journal Club and other presentations. The Logbook verified by the course coordinator/concerned faculty in-charge shall be certified by the Head of the Department and presented in the Final Practical Examination

## **Examination rules and regulations:**

1. A student needs to pass in all theory paper(s) and practical examination in the I year to progress to the II year.
2. In the I and II years, If the candidate fails to pass in the practical examination, he/she will be required to appear in all the theory papers and the practical in the supplementary examination. If the candidate passes in the practical examination but fails only in one or

two theory papers, he/she will be permitted to appear only for that theory paper(s) in the supplementary examination, provided he/she has an aggregate of 50% or above in theory papers. If the candidate passes in the practical examination but fails in three or four theory papers, he/she will be required to appear in all the theory papers and the complete practical examination in the supplementary examination.

3. In case of fail result in any theory subject and/or practical in the 2<sup>nd</sup> attempt (supplementary examination), the student will study with the next junior year's batch and will have to reappear for Year 1/ Year 2 examination again the next year (3<sup>rd</sup> attempt). A student failing in any one or more theory subject(s) and/or practical examination in this attempt will reappear in a supplementary examination (to be held within 6 weeks) in the particular subjects (4<sup>th</sup> attempt).
4. If a student fails even in the 4<sup>th</sup> attempt, no further chances will be given, and his/her name will be struck off the rolls of JIPMER.
5. A student needs to complete the entire 2-year course within 4 years from the date of enrolment (twice the duration of the course), beyond which he/she will not be allowed to appear in any examination. Any exception for extenuating reasons (e.g. prolonged illness of the candidate, family problems, natural calamities, etc.) will be made only after approval of the Academic Advisory Committee and Head of the institution.
6. No grace marks will be awarded for either theory or practical examinations, under any circumstances.

**Pass criteria:**

1. A minimum 40% in each of the theory paper and overall aggregate, in theory (all papers put together) should obtain a minimum of 50% marks.
2. A minimum of 50% in practical separately.
3. A minimum of 50% of the grand total (theory, practical, project and internal assessments).



**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY FIRST YEAR EXAMINATION**  
**PAPER I**  
**General Microbiology, Immunology & Basics of molecular biology**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**  
**Each question carries TEN marks.**

1. Discuss the role of various components of bacterial cell in establishment of infection.
2. Discuss various sporicidal disinfectants.
3. Discuss the laboratory methods of Water Analysis.
4. Discuss different classes of Biosafety cabinets.
5. Classify hypersensitivity & discuss mechanism of Type IV hypersensitivity reaction.
6. Hybridoma technology.
7. List the various immunoglobulins. Draw and label the structure of IgG. List the uses of the immunoglobulin IgG.
8. Discuss the principle and procedural steps of conventional PCR.

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**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY FIRST YEAR EXAMINATION**  
**PAPER II**  
**Systematic Bacteriology**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**  
**Each question carries TEN marks.**

1. Discuss the toxin mediated infections caused by *Staphylococcus aureus*
2. Discuss the laboratory diagnosis of diphtheria.
3. Discuss the laboratory diagnosis of gas gangrene.
4. Discuss the laboratory diagnosis of enteric fever.
5. Discuss the laboratory diagnosis of cholera.
6. Describe the collection and processing of a sputum specimen for culture of *Mycobacterium tuberculosis* including the safety precautions.
7. Discuss laboratory diagnosis of Rickettsial infections.
8. Discuss laboratory diagnosis of syphilis.

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**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY FIRST YEAR EXAMINATION**  
**PAPER III**  
**Virology**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**

**Each question carries TEN marks.**

1. Discuss the antemortem diagnosis of rabies in humans.
2. Discuss vaccination against polio.
3. Discuss laboratory diagnosis of influenza.
4. Discuss pathogenesis of dengue.
5. Laboratory diagnosis of HIV in infants.
6. Discuss laboratory diagnosis of viral gastroenteritis.
7. Discuss the types of cell lines and their uses.
8. Discuss various markers of hepatitis B & their prognostic importance.

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**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY SECOND YEAR EXAMINATION**  
**PAPER I**  
**Parasitology**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**

**Each question carries TEN marks.**

1. Enumerate the differences between *Entamoeba histolytica* & *E. dispar*. Discuss the laboratory diagnosis of amoebic liver abscess.
2. Discuss various staining methods used in laboratory diagnosis of parasitic infections.
3. Discuss the newer advances in diagnosis of malaria.
4. Discuss the laboratory diagnosis of intestinal coccidian parasitic infections.
5. Discuss the laboratory diagnosis of neurocysticercosis.
6. Discuss the laboratory diagnosis of lymphatic filariasis.
7. Discuss the etiopathogenesis and laboratory diagnosis of *Paragonimus westermanii*.
8. Discuss various stool concentration techniques for intestinal parasitic infections.

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**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY SECOND YEAR EXAMINATION**  
**PAPER II**  
**Mycology & Animal Experiments**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**  
**Each question carries TEN marks.**

1. Discuss various phenotypic methods to speciate *Candida* spp.
2. Discuss the laboratory diagnosis of mycetoma.
3. Discuss the laboratory diagnosis of Dermatophyte infections.
4. Discuss the methods of antifungal susceptibility testing.
5. Discuss the role of animal models in leprosy.
6. Discuss the role of guinea pig in diagnostic microbiology.
7. Discuss the procedure and use of slide culture technique.
8. Discuss the pathogenesis and laboratory diagnosis of Cryptococcal meningitis.

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**MODEL QUESTION PAPER**  
**MSc MLT MICROBIOLOGY SECOND YEAR EXAMINATION**  
**PAPER III**

**APPLIED, ADVANCED MOLECULAR BIOLOGY AND INSTRUMENTATION**

**Time: 3 hours**

**Max. Marks: 80**

**Answer all the questions.**

**Each question carries TEN marks.**

1. Discuss various automated methods for identification and antimicrobial sensitivity testing.
2. TrueNat for tuberculosis- principle, advantages, and disadvantages.
3. Describe various means of bioinformatics. What are the various applications of computer in a laboratory?
4. Discuss various isothermal amplification techniques
5. Role of whole genome sequencing of bacterial pathogens in nosocomial outbreak analysis.
6. Enzyme-linked immunofluorescence assay (ELFA)-principle and application in diagnostic microbiology.
7. Discuss different methods of RNA isolation from clinical samples.
8. Discuss the principles and probes used in real time PCR.

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