PERIYAR UNIVERSITY
SALEM – 11

PERIYAR INSTITUTE OF DISTANCE EDUCATION (PRIDE)

SYLLABUS

NON-SEMESTER PATTERN

M.Sc., Microbiology

(Candidates admitted from 2007-2008)
PERIYAR INSTITUTE OF DISTANCE EDUCATION

SALEM – 11

Non-Semester Pattern

M.Sc., MICROBIOLOGY

(Candidates admitted from 2007-2008)

REGULATIONS

1. Condition for Admission

A candidate who has passed a Bachelor degree in Science with Microbiology / Botany / Zoology / Environmental Science / Biotechnology / Biochemistry / Chemistry / Home Science / Nutrition and Dietetics / B.Sc., MLT / Genetics / Bio-informatics / Marine Biology or a Bachelor degree in Agriculture / Animal Science / Medicine or Veterinary Science / Pharmacy and including Indian Forms of Medicines and Homeopathy degree of this University or any of the above degree of any other university accepted by the Syndicate as equivalent thereto, subject to such conditions as may be prescribed thereto shall be permitted to appear and qualify for the M.Sc., Microbiology degree examination of this University after a course of study of two academic years.

2. Duration of the Course

The course for the degree of Master of Applied Microbiology shall consist of two academic years.

3. Course of Study

The course of study shall comprise instruction in the following subjects according to the syllabus and books prescribed from time to time.
I – Year
Main Paper 1  -  General Microbiology
Main Paper 2  -  Microbial Genetics and Immunology
Main Paper 3  -  Applied Microbiology
Main Paper 4  -  Biostatistics and Bioinstrumentation

Main Practical – I

II – Year
Main Paper 5  -  Medical Microbiology
Main Paper 6  -  Soil and Environmental Microbiology
Main Paper 7  -  Biotechnology

Main Practical – II

Project Work

4. Examinations

The theory examination shall be three hours duration to each paper at the end of the each year. The candidate failing in any subject(s) will be permitted to appear for each failed subject(s) in the subsequent examinations. The practical examinations for PG course should be conducted at the end of the year.

At the end of the second year viva-voce will be conducted on the basis of the Dissertation / Project work submitted by the student. The viva – voce will be conducted by one internal and one external examiner jointly.
5. Scheme of Examinations

<table>
<thead>
<tr>
<th>S. No.</th>
<th>Paper</th>
<th>Title of the Paper</th>
<th>Exam Duration</th>
<th>Max. Marks</th>
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<tbody>
<tr>
<td></td>
<td>Main Paper 1</td>
<td>General Microbiology</td>
<td>3 hrs</td>
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<tr>
<td>1</td>
<td>Main Paper 2</td>
<td>Microbial Genetics and Immunology</td>
<td>3 hrs</td>
<td>100</td>
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<td>2</td>
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<td>Applied Microbiology</td>
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<td>3</td>
<td>Main Paper 4</td>
<td>Biostatistics and Bioinstrumentation</td>
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<td>4</td>
<td>Main paper 5</td>
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<td></td>
<td>Main Practical – I</td>
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<td>8 hrs / day, two consecutive days</td>
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<td></td>
<td>Main paper 6</td>
<td>Medical Microbiology</td>
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<tr>
<td>5</td>
<td>Main paper 7</td>
<td>Soil and Environmental Microbiology</td>
<td>3 hrs</td>
<td>100</td>
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<tr>
<td>6</td>
<td>Main paper 8</td>
<td>Biotechnology</td>
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<td>Main Practical – II</td>
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<td>Project Work</td>
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<td>Total</td>
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6. Question paper model for theory and practical

M.Sc., MICROBIOLOGY

Question Paper Pattern (Non-semester)

(Theory Paper)

Time 3 Hours Max. Marks : 100

Part – A 5x5=25

Answer all questions
(Two Questions from each unit with internal choice)

Part – B 5x15=75

Answer all questions
(Two Questions from each unit with internal choice)
QUESTION MODEL FOR PRACTICALS
(Non-semester pattern)

Time 8 Hours / Day
2 Consecutive days  Max. Marks : 100

3 Major questions, each carry 25 marks (3x 25 = 75 marks)
For both year  Record  25 marks

- Project work  (100 Marks)
- Project Report  (075 Marks)
- Viva – voce  (025 Marks)

7. Format to be followed in dissertation

The formats / certificate for dissertation to be submitted by the students are given below.

Format for the preparation of project work
a) Title Page
b) Bonafide certificate
c) Acknowledgement
d) Table of Contents

CONTENTS

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<td>Results</td>
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<tr>
<td>6</td>
<td>Summary</td>
<td></td>
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<tr>
<td>7</td>
<td>Reference</td>
<td></td>
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</tbody>
</table>
Format of the Certificate

CERTIFICATE

This is to certify that the dissertation entitle _______ \( \textit{title of the dissertation} \) submitted in part fulfillment of the requirement of the degree of Master of Science in Microbiology to the Periyar University, Salem is a record of bonafide research work carried out by_____ \( \textit{name of the candidate} \) under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part of full in any scientific or popular journals or magazines.

Signature of the Co-ordinator  
Signature of the Guide

Examiner(s)
1.

2.

8. Passing Minimum

The candidate shall be declared to have passed the examination if the candidate secures not less than 50 marks in the University examination in each theory paper.

For the Practical paper, a minimum of 50 marks out of 100 marks in the University examination and the record notebook taken together. There is no passing minimum for record note book. However submission of a record note book is a must.
For the project work and viva-voce the candidate should secure 50% of the marks for pass. The candidate should compulsorily attend viva-voce examination to secure pass in that paper.

Candidate who does not obtain the required minimum marks for a pass in a paper / project report shall be required to appear and pass the same at a subsequent appearance.

9. Classification or successful Candidates

Candidates who secure not less than 60% of the aggregate marks in the whole examination shall be declared to have passed the examination in **First Class**.

All other successful candidates shall be declared to have passed in the **Second Class**.

Candidates who obtain 75% of the marks in the aggregate shall be deemed to have passed the examination in **First Class with Distinction** provided they pass all the examinations prescribed of the course at the first appearance.

Candidates who pass all the examinations prescribed for the course in the first instance and within a period of two academic years from the year of admission to the course only are eligible for **University Ranking**.

10. Maximum Duration for the completion of the PG Programme

The maximum duration for completion of the PG programme shall not exceed 4 years. Thereafter, candidate will be permitted to appear for the examination only under the regulations then in force.
MAIN PAPER I – GENERAL MICROBIOLOGY

Unit I – Origin and Evolution of Microbiology – Contributions of Early Microbiologists – Classification of Microorganisms – Hackel’s three kingdom concepts – Whittaker’s five kingdom concepts – Classification and Salient features of bacteria according to the Bergey’s manual of determinative bacteriology – Cyanobacteria.


Text Books

Reference Book
MAIN PAPER II – MICROBIAL GENETICS AND IMMUNOLOGY

**Unit – I** – DNA – Evidences to prove DNA as genetic material – structure, Chemical composition and different forms of DNA. RNA – Evidences to prove RNA as genetic material – Structure and types of RNA. Gene transfer mechanisms – Transformation, Conjugation, Transduction and Transfection. DNA Recombination – Holiday model.


**Unit – IV** – Antigen and antibody reactions – Agglutination, Precipitation, complement fixation, Immunofluorescence, ELISA, and RIA. Complement activation – Classical and Alternative pathways – Regulation and biological consequences of activation of complement. Structure and functions of Class I and Class II MHC molecules. Transplantation immunology – Mechanism of graft rejection, Clinical manifestation, HLA tissue typing and immunosuppressive therapy.

Text Books

MAIN PAPER III – APPLIED MICROBIOLOGY

Food & Diary Microbiology

Unit – II – Food – borne infections and intoxications – Bacterial and non – bacterial with examples of infective and toxic types – Laboratory testing procedures – Preventive measures – Food control agencies and its regulations fermented dairy products – cheese, butter other fermented products – Fermented vegetables, oriental fermented foods.

Industrial and pharmaceutical microbiology


**Text Books**


MAIN PAPER IV - BIOSTATISTICS & BIOINSTRUMENTATION


REFERENCES

Biostatistics


Bioinstrumentation

MAIN PAPER V – MEDICAL MICROBIOLOGY


Unit – V – General diagnosis of meningitis, Acute respiratory tract infections, Urinary tract infection, Gastroenteritis, Pyrexia of Unknown origin, Hospital acquired infection, Sexually transmitted diseases and Aids.
**Text Books**


**Reference Book**


**MAIN PAPER VI – SOIL AND ENVIRONMENTAL MICROBIOLOGY**


**Unit – III-** Microbial interaction between microbes, interaction of microbes with plants – Rhizoplane, Rhizosphere, Pyllosphere, Spermosphere, Mycorrhiza. Biofertilizer and Biocontrol agents – *Rhizobium, Azotobacter, Azospirillum* – Mass multiplication, field application and crop response. Biopesticide (Bacterial, fungal and viral) – Biological control (*Trichoderma viridae, Pseudomonas fluorescens*) – Mode of action, formulation and application methods.


**Text Books**

**MAIN PAPER VII – BIOTECHNOLOGY**


**Unit – II –** Gene cloning vectors – Plasmids, bacteriophages, phagemids, cosmids, artificial chromosomes, restriction mapping of DNA fragments. cDNA synthesis.

**Unit – III –** PCR Methods and application. DNA sequencing methods – dideoxy and chemical methods. Sequencing assembly. Automated sequencing. Genomic sequencing and physical mapping of genomes.


**Text Books**


**Reference Books**

MAIN PRACTICAL – I

General Microbiology

♦ Handling and maintenance of bright field microscopy.

♦ Micrometry – Measurement of microorganisms

♦ Motility determination – Hanging drop method.

♦ Staining – Simple, Gram’s, Acid – fast, Spore, Capsule

♦ Pure culture techniques : Streak plate, pour plate, spread plate.

♦ Growth curve

♦ Effect of various factors on growth of bacteria
  ❖ Temperature
  ❖ pH

♦ Biochemical tests for identification of bacteria

♦ Antibiotic sensitivity test – Kirby – Bauer & Stoke’s methods.

Microbial Genetics

♦ Isolation of mutants by replica plating and gradient plate technique.

♦ Mutagenesis : Induction and isolation of Auxotrophic / drug resistant mutants of bacteria.

♦ Bacterial conjugation

♦ Bacterial transformation

♦ Phage titration – Induction of lysogeny, lytic cycle – Lambda phage.

♦ Isolation of phage from sewage.

♦ Isolation of genomic DNA from blood cells.
**Immunology**

- ABO Blood grouping – Rh typing and cross matching.
- Agglutination tests.
  - WIDAL – slide and tube test
  - RA test
  - ASO test
  - CRP test
  - TPHA test
- Precipitation reaction
  - Ouchterlony’s Double Immunodiffusion test (ODD)
  - Counter immunoelectrophoresis (CIE)
- Rapid plasma reagin test – VDRL test
- Diagnosis of HIV and Hepatitis viruses by ELISA.

**Applied Microbiology**

**Food & Diary Microbiology**

- Microbiological analysis of food products
- Detection of bacteria in milk by Standard plate count
- Reductase test for milk – Methylene Blue / Resazurin.
- Isolation of Lactobacilli and Streptococci from curd.
- Microbiological examination of spoiled foods – Bacteria / Fungi
  - Vegetables and fruits
  - Proteinaceous foods
  - Dairy foods
- Examination of microbial load in soft drinks.
- Examination of microbial load in ice – creams.

**Industrial & Pharmaceutical Microbiology**
Screening of antibiotic producing organisms from soil.

Screening of amylase enzyme producing organisms from soil.

Antibiotic sensitivity test disc preparation

Antibiotic sensitivity test – Kirby – Bauer, Stoke’s

MIC determination by filter paper disc assay.

Evaluation of Disinfectant – Phenol co-efficient test.

MAIN PRACTICAL – II

Medical Microbiology

Bacteriology

♦ Collection and transport of clinical specimens from sputum, pus, urine, faeces, blood and CSF.

♦ Identification of pathogenic bacteria from clinical specimens.

- *Staphylococcus* spp
- *Bacillus* spp
- *Escherichia* spp
- *Klebsiella* spp
- *Proteus* spp
- *Salmonella* spp
- *Shigella* spp
- *Vibrio* spp
- *Pseudomonas* spp
- *Yersinia* spp

Parasitology

♦ Examination of parasities in clinical specimens – Ova / cysts in faeces – Direct and concentration methods – formal ether and zinc sulphate methods – Saturated saline – technique.

- *Entamoeba histolytica*
- *Entamoeba coli*
- *Giardia intestinalis*
- *T.solium*
- *Ascaris spp*
- *Ankylostoma spp*

♦ Blood smear examination for malarial parasites

Mycology

♦ Collection and transport of clinical specimens – Direct microscopy – KOH and Lactophenol cotton blue preparations for skin scrapings, for fungi and for scabies mites – Cultivation of fungi – Culture media and their uses in fungal cultivation.

♦ Isolation and identification of fungal pathogens from clinical specimens, their biochemical and specific identification tests.
**Clinical specimens**

i) Nail / Skin scrapping

ii) Blood

iii) CSF

iv) Urine

v) Pus

**Fungi**

- Dermatophytes
- *Candida* spp.
- *Cryptococcus* spp.
- *Histoplasma* spp.
- *Cryptococcus* spp.
- *Candida* spp.
- *Cryptococcus* spp.

**Virology**

- Viral cultivation methods
  
  - Egg inoculation techniques (All routes)

- Serological tests: Serodiagnosis of various viral diseases
  
  - ELISA – HBV, HCV, HIV
  
  - Haemagglutination (HA) and Haemagglutination inhibition (HI) tests.

**Soil & Agricultural Microbiology**

- Enumeration of microbial population from soil
  
  - Bacteria, Fungi, Actinomycetes

- Isolation of free living nitrogen fixing bacteria from soil – *Azotobacter*

- Isolation of symbiotic Nitrogen fixing bacteria from root nodule – *Rhizobium*

- Enumeration of microorganisms from phyllosphere

- Study of cyanobacteria

- Examination of plant diseases

**Bacterial Disease**

**Fungal Disease**
Blight of rice  Wilt
Citrus canker,  Blast of rice
Brown rot of potato  Red rot of sugarcane
Tikka leaf spot of ground nut  Alternaria leaf spot

**Environmental Microbiology**

- Bacterial examination of water (qualitative)
- Standard plate count (quantitative test)
- Membrane filter technique
- Enumeration of microorganism from air
  - Settle plate technique
  - Air sampling technique
- Estimation of dissolved oxygen
- Estimation of BOD and COD.

**Genetic Engineering**

- Separation techniques – Paper, Thin layer & Column Chromatography
- Separation of proteins using SDS–PAGE
- Immobilization of microorganisms
- Isolation of plasmid (PUC series plasmids of *E. coli*) separation by Agarose gel electrophoresis.
- Western blotting, PCR (Demonstration)
PRACTICAL REFERENCES


6. Myer's and Koshi's Manual of Diagnostic Procedures in Medical Microbiology and Immunology / Serology (2001). Published by Department of Clinical Microbiology, CMC and Hospital, Vellore, Tamil Nadu.

7. Sundararaj T. Microbiology – Laboratory Manual. Revised and Published by Aswathy Sundararaj, No.5. 1st Cross Street, Thirumalai Nagar, Perundgudi, Chennai.


