



# ALAGAPPA UNIVERSITY



(A State University Established in 1985)

Karaikudi - 630003, Tamil Nadu, India



## FACULTY OF SCIENCE DEPARTMENT OF MICROBIOLOGY



### M.Phil., MICROBIOLOGY

## REGULATIONS AND SYLLABUS

(For the candidates admitted from the  
Academic Year 2022 - 2023)

# DEPARTMENT OF MICROBIOLOGY

## M.PHIL. MICROBIOLOGY

### REGULATIONS AND SYLLABUS

[For the candidates admitted from the Academic Year 2022 – 2023 onwards]



### ALAGAPPA UNIVERSITY

(A State University Accredited with “A+” grade by NAAC (CGPA: 3.64) in the Third Cycle and Graded as Category-I University by MHRD-UGC)

Karaikudi - 630003, Tamil Nadu

# Regulation and Syllabus

## 1. a. Programme general objectives

Microbiology has become increasingly important to human society. It has emerged as one of the most important branches of the life sciences. As microbes practically affect all activities of our lives like food, clothing, shelter, health hygiene, etc., microbiology has made vast progressive strides in all these fields in little more than a century to improve the quality of our lives.

Hence our task is to introduce the M.Phil. Programme in Microbiology to educate the postgraduate students in these captivating fields. Rigorous and comprehensive in approach, this syllabus presents essential contents in a detailed, clear, and direct way. This programme is offered under the Choice Based Credit System (CBCS). The CBCS enables the students to select a variety of courses as per their interest and requirements. The programme is structured in such a way to impart more knowledge in science, in particular in microbiology.

## b. Programme specific objectives

1. To acquire knowledge on the advances of microbiology
2. To make the students understanding on fundamental interaction of the microbes with other biological and non biological elements.
3. To understand the rationale in the field of applied microbiology
4. To enable the students technically sound in the microbial techniques
5. To prepare the students to do research on the recent trends in Microbiology
6. To make them expert in the field of applied Microbiology

## c. Programme outcome

After successful completion of this course, the student will be able to:

1. Become an expert in the field of microbiology in the research aspect.
2. Students will receive elaborate knowledge in the fields of Microbiology, Biochemistry, Microbial Genetics, Molecular Biology, Food, Agricultural, Environmental, Medical, and Applied Microbiology.
3. Will be capable of carrying out any microbiology-related tasks in industries, medical labs, research labs, etc.

A postgraduate degree in microbiology prepares the students for a career in research. It is important to start thinking about your plans after your master's or PhD so that you can make the most of the ever-increasing options available to postgraduate students.

## II. Eligibility for Admission

A candidate, who has passed the M.Sc., degree in any life sciences discipline as the main course of study at any university accepted by the syndicate as equivalent thereto, subject to such conditions as may be prescribed, shall be permitted to appear and qualify for the M.Phil. degree in microbiology of this university after a course of study of one academic year.

### III. Duration of the Course

The course for the degree of M.Phil. Microbiology shall consist of one academic year divided in to two semesters. Each Semester consist of 90 working days.

### IV. Course of Study: M.Phil Microbiology

### V. Examinations

The examination shall be of three hours duration for each course at the end of each semester. The candidate failing in any course(s) will be permitted to appear for each failed course(s) in the subsequent examination.

**For subject 517102**, examinations shall be held at the end of the first semester. It will be conducted by the department in a single session for all the students. The guide has to set the question paper confidentially and hand it over to the HOD well in advance. The marks obtained by the candidate, along with the syllabus, question paper, and valued answer scripts, shall be sent to the Controller of Examinations.

At the end of the second semester, a viva-voce will be conducted on the basis of the dissertation report submitted by the student. The viva-voce will be conducted jointly with the following members: the H.O.D., a member of the viva examination; the research supervisor; and an external examiner from outside (selected by the university authority from the panel of four members).

### VI. Question Paper Pattern – Theory

#### M.Phil Microbiology

**Time: 3 Hours**

**Max. Marks: 75**

**Answer all questions either (a) or (b)**

**(5 x 15 = 75 marks)**

1. (a) or (b)
2. (a) or (b)
3. (a) or (b)
4. (a) or (b)
5. (a) or (b)

**Each Question is represented from the same unit.**

### VII. Dissertation Work

Dissertation Work	–	150 marks
Viva-Voce	–	50 marks
Total	–	200 marks



**(a) Plan of Work:**

The student should prepare a plan of work under the supervision of a guide for the dissertation, get the approval of the guide, and submit it to the university during the second semester of their study. The duration of the dissertation research shall be a minimum of six months in the second semester.

**(b) Project Work outside the Department:**

In case the student stays away for work from the Department for more than one month, specific approval of the university should be obtained.

**(c) No. of copies/distribution of project work:**

The students should prepare three copies of their dissertation and submit the same for evaluation by examiners. After evaluation, one copy is to be retained in the department library, one copy is to be submitted to the guide, and one copy can be held by the student.

**(d) Format to be followed:**

The format/certificate for dissertation to be submitted by the students is given below:

Format for the preparation of project work:

- (a) Title page
- (b) Bonafide Certificate
- (c) Acknowledgement
- (d) Table of contents

**CONTENTS**

<b>Chapter No.</b>	<b>TITLE</b>	<b>Page No.</b>
1.	Introduction	
2	Review of Literature	
3.	Materials and Methods	
4.	Results	
5.	Discussion	
6.	Summary	
7.	References	

**Format of the Title Page:**

**TITLE OF THE PROJECT**

A Dissertation Submitted to the Alagappa University, Karaikudi -630 003 in Partial Fulfillment of  
the Requirement for the Award of Degree of

**MASTER OF PHILOSOPHY IN MICROBIOLOGY**

By

Students Name

Register Number

Supervisor:

University Emblem

Department of Microbiology

Alagappa University

Karaikudi – 630 003

Month and Year

**Format of Declaration of the Candidate:**

Name and class of the student

**DECLARATION**

I hereby declare that the Project entitled \_\_\_\_\_ submitted to Alagappa University for the award of the degree of Master of Philosophy in Microbiology is my original work and that it has not been previously formed the basis for the award of any degree, diploma/associate ship or any other similar title of any other University or Institution.

Signature of the Student

**Format of the Certificate:**

**CERTIFICATE**

This is to certify that the project entitled -----  
-----submitted in partial fulfillment of the requirement of the degree of Master of Philosophy in  
Microbiology to the Alagappa University, Karaikudi is a record of bonafide research work carried out  
by -----under my supervision and guidance and that no part of the project has been  
submitted for the award of any degree or diploma.

HOD Endorsement

Place:

Date:

Signature of Guide



## Classification of Successful Candidates

### P.G. Programme

MARKS	GRADE POINT	CGPA	LETTER GRADE	Description
96 and above	10	9.51 and above	S+	First Class - Exemplary
91 – 95	9.5	9.01 – 9.50	S	
86 – 90	9.0	8.51 – 9.00	D++	First Class – Distinction
81 – 85	8.5	8.01 – 8.50	D+	
76 – 80	8.0	7.51 – 8.00	D	
71 – 75	7.5	7.01 – 7.50	A++	First Class
66 – 70	7.0	6.51 – 7.00	A+	
61 – 65	6.5	6.01 – 6.50	A	
56 – 60	6.0	5.51 – 6.00	B	Second Class
50 – 55	5.5	5.00 – 5.50	C	
Below 50	-	Below 5.00	F	Fail
			AA	Absent

Passing Minimum: 50%, P: Pass, ESE: End Semester Examination, CIA: Continuous Internal Assessment

$$GPA = \frac{\sum (CDT * GPT)}{\sum CDT}$$

Where: CDT = No. of credits of major allied and elective courses

GPT = Grade Point (obtained by dividing the percentage of marks scored by 10)

Note: Extra Grade Points and Marks are not considered for GPA and Total Marks Calculations.

	<u>Category (CGY)</u>
CGY – Category	1. Theory (Core)
CDT – Credit	2. Practical (Core)
GRD – Grade	3. Inter-disciplinary – Theory
GPT – Grade Point	4. Inter-disciplinary – Practical
GPA – Grade Point Average	5. Elective / Optional
CGPA – Cumulative Grade Point Average	6. Comprehensive Viva / Seminar
	7. Extension Programmes
	8. Project and Viva – Voce



**IX. Syllabus****X. Syllabus - M.Phil Microbiology**

<b>Semester – I</b>					
<b>Course Code</b>	<b>Course Title</b>	<b>Credits</b>	<b>Max Marks I</b>	<b>Max Marks E</b>	<b>Total</b>
<b>517101</b>	CC I - Research Methodology	4	25	75	100
<b>517102</b>	CC II - Topic of Research	4	25	75	100
<b>517103</b>	EC I - General Skills In Science	4	25	75	100
Total		12	75	225	300
<b>Semester – II</b>					
<b>517201</b>	CC III - Applied Microbiology	4	25	75	100
<b>517202</b>	CC IV - Project Work	8	200 (Thesis 150 + Viva Voce 50)		200
Total		12	25	275	300
Total for All Semesters		24	100	500	600

<b>Semester - I</b>		
<b>Course code:</b> <b>517101</b>	<b>Research Methodology</b>	<b>Credits:4</b>
<b>Unit –I</b>		
<b>Objective 1</b>	<b>Acquire knowledge on Literature collection</b>	
<b>Literature collection:</b> Definition, basic concepts, objectives, significance and techniques of research, finding research materials – literature survey, compiling records. Scientific documents– research paper, review paper, book reviews, theses, conference and project reports.		
<b>Outcome 1</b>	<b>Discuss about research paper and review paper</b>	
<b>Unit-II</b>		
<b>Objective 2</b>	<b>Discuss the Basic on analytical techniques</b>	
<b>Basic analytical techniques:</b> pH meter- determination of pH –buffers – principle –operation and description of the apparatus. Dissociation constant of acids – titration of weak acid with a strong base. Colorimetry - ultraviolet - visible spectrophotometry - principles, instrumentation and applications, Fluorescence spectrophotometry, FTIR and XRD- , instrumentation and applications.		
<b>Outcome 2</b>	<b>Students acquire knowledge on analytical techniques</b>	
<b>Unit III</b>		
<b>Objective 3</b>	<b>To acquire knowledge on Chromatographic techniques</b>	
<b>Chromatography:</b> paper, column, thin layer, gas, liquid and ion exchange chromatography – Principle - description– applications of various chromatography. Electrophoresis – Principle, method and application of acrylamide and agarose gel electrophoresis. Two dimensional gel electrophoresis (IEF), DGGE, trflp and RAPD.		
<b>Outcome 3</b>	<b>Students can understand the principles of Chromatographic techniques</b>	
<b>Unit IV</b>		
<b>Objective 4</b>	<b>Acquire knowledge on basic principles of microscope</b>	
<b>Basic principles of microscope:</b> Basic principles and sedimentation - types of centrifuge –density gradient and ultra-centrifuge – applications. Basic principles of microscope – compound, electron, phase contrast, fluorescent, microscopy, TEM, SEM, AFM – applications.		
<b>Outcome 4</b>	<b>Understand the principles of microscope</b>	
<b>Unit V</b>		
<b>Objective 5</b>	<b>Illustrate Spreadsheet tools</b>	
<b>Spreadsheet tools :</b> Introduction to spreadsheet applications, features, Using formulas and functions, Data storing, Features for Statistical data analysis, Generating charts / graph and other features, Tools – Microsoft Excel or similar. Presentation tools: Introduction, features and functions, Presentation of Power Point Presentation, Customizing presentation, Showing presentation, Tools – Microsoft Power Point or Similar. Writing of Synopsis and dissertation and thesis.		

<b>Outcome 5</b>	<b>Develop knowledge about the Spreadsheet tools</b>
<p><b>Suggested Readings:</b></p> <p>Bajpai, S. (2014). <i>Biological Instrumentation and Methodology: (Tools and Techniques of Biology)</i>(Revised). New Delhi: Chand &amp; Company Ltd.</p> <p>Devlin, T.M. (1982). <i>Devlin: Textbook of Biochemistry – With Clinical Correlations</i>, John Wiley &amp; Sons.</p> <p>Gurumani, N. (2016). <i>Research Methodology for Biological Sciences</i> (1<sup>st</sup> ed). Chennai: MJP Publishers, A unit of Tamilnadu Book House.</p> <p>Lederberg, J. (2000). <i>Encyclopedia of Microbiology</i> Volume 4 (2<sup>nd</sup> ed). Academic Press.</p> <p>Lehninger A.L. (2015). <i>Biochemistry</i>, Kalyani Publishers</p> <p>Palanivelu, P. (2009). <i>Analytical biochemistry and separation techniques – A Laboratory Manual</i> (4<sup>th</sup>ed). Madurai: Twenty first Century Publications.</p> <p>Plummer, D.T. (2003). <i>An Introduction of practical biochemistry</i> (3<sup>rd</sup> ed). New Delhi: Tata McGrawHill Publishing Company Ltd.</p> <p>Prave, P., Faust, U., Sittig, W. and Sakatsch, D.A. (2004). <i>Fundamentals of Biotechnology</i>. (1<sup>st</sup> ed).India: Panima Publishing Corporation.</p> <p>Sawhney, S.K. &amp; Singh, R., (2005). <i>Introductory Practical Biochemistry</i> (2<sup>nd</sup> ed). Alpha Science International Ltd.</p> <p>Verma, A.S., Surajit, D &amp; Anchal, S. (2014). <i>Laboratory Manual for Biotechnology</i>. New Delhi: S. Chand and Company Ltd..</p>	
Name of the Course Teacher: T. Kavitha	

## Semester I

**Course II : Topic of Research**  
**Code : 517102**  
**Credit : 4**

**Maximum Marks: 100**  
**Internal Marks : 25**  
**External Marks : 75**

**(It is a guide's paper. Sub title and syllabus have to be given by the guide as per the guidelines given below)**

### **Unit I – FUNDAMENTAL CONCEPTS**

Identification of research problem. Fundamental information on the research topic selected. Significance of the research topic chosen.

*(A minimum of 20 pages of materials to be prepared)*

### **Unit II – LITERATURE SURVEY I**

Literature survey on the research problem. Use of text books, reference materials, journals, internet and specialized softwares for literature collection. The period of literature search restricted upto the year 2009.

*(A minimum of 6 research articles may be given)*

### **Unit III – LITERATURE SURVEY II**

In-depth study of published papers, seminar / conference proceedings on the identified research problem. The period of literature search extended from the year 2010 to the current date. National and International status on the research topic.

*(A minimum of 6 research articles may be given)*

### **Unit IV – PREPARATORY METHODS**

Procurement or synthesis of chemicals needed for the research problem. Database, storage and handling of specified chemicals. Preparatory methods to execute the experimental works. Details on the principle, instrumentation and working of instruments identified for the problem.

*(A minimum of 20 pages of materials to be prepared)*

### **Unit V – CHARACTERIZATION TECHNIQUES**

Types of instrumental techniques used for the identified research problem. Characterization of research materials, interpretation of results and preparation of manuscript. Writing of Research report / thesis. Presentation of research output in scientific seminar / conference.

*(A minimum of 30 pages of materials to be prepared)*

<b>Semester - I</b>		
<b>Course code: 517103</b>	<b>General Skills in Science</b>	<b>Credits:4</b>
<b>Unit –I</b>		
<b>Objective 1</b>	<b>Acquire knowledge on computer hardware and software devices</b>	
<b>Introduction to Computers:</b> Computer Hardware: Input devices and media-magnetic device and media-output devices and media-storage device and media-computer architecture – system software: types, operating system and translators – Application software: types of language – application packages – integrated software – Introduction to operating system – Working with windows and office programs – Internet, Website and Email		
<b>Outcome 1</b>	<b>Recollect the importance of computer hardware and software devices</b>	
<b>Unit-II</b>		
<b>Objective 2</b>	<b>Discuss the applications of computer and Computer operating skills</b>	
<b>Computer operating skills :</b> Starting a program and opening a document – saving and naming the document – create file and folders – deleting and un-deleting a document – closing a document – renaming and moving a document – finding a document – MS office: Word, Excel, Access, Powerpoint, outlook and integrated office applications – C programming – Principles, classes and structure of C++ programming		
<b>Outcome 2</b>	<b>Develop knowledge about the Computer operating skills</b>	
<b>Unit III</b>		
<b>Objective 3</b>	<b>Communication skills in English</b>	
<b>Communication skills in English :</b> Understanding communication – greeting and introducing – making requests – asking for and giving permission – offering help – giving instruction and directions art of small talk participating in conversation – making a short formal speech – Describing the people, place, events and things. Telephone skill: understanding, handling calls, leaving message and making request. Written communication: report writing, note making – career skills: curriculum vita and cover letter – Facing an interview and presentation skills – academic listening		
<b>Outcome 3</b>	<b>Educate learners about the Communication skills</b>	



<b>Unit IV</b>	
<b>Objective 4</b>	<b>Students can discuss the Pedagogical skill for science teachers</b>
<p><b>Pedagogical skill for science teachers:</b> Science Teacher: Qualification, teacher competencies and professional growth. Theory and models of curriculum development: Concept and Technical scientific models of curriculum development – planning a science library – Handling of practical classes. Educational technology and classroom pedagogy: educational Technology – Concept, Emerging technologies – New technologies on methodology of teaching, learning experiences and curriculum development. Micro-teaching: Meaning, teaching, skill of stimulus variation, questioning, explanation, reacting, linking and benefits</p>	
<b>Outcome 4</b>	<b>Categorize and elaborate the importance of Pedagogical skill for science teachers</b>
<b>Unit V</b>	
<b>Objective 5</b>	<b>Illustrate clearly about the Practical training</b>
<p><b>Practical training:</b> Preparation of charts and models for handling classes of science teacher – Creating management documents e.g. Curriculum Plan, Time Table scheduling, Evaluation – Strategies etc – Learning to write and draw on the blackboard – Preparation of overhead projector presentations – Preparation of power point / LCD presentations – Preparation of micro-teaching skills – Preparation of teaching materials – seminar classes for PG students – Preparation of album</p>	
<b>Outcome 5</b>	<b>Create and evaluate Practical training</b>
<p><b>Suggested Readings:</b></p> <p>Benny Raphael, F.C.Smith. (2003). <i>Fundamentals of computer-aided engineering</i>, John wiley &amp; sons.</p> <p>Curtis Frye. (2004). <i>Microsoft office Excel 2003 step by step</i>. Microsoft press.</p> <p>Greg Harvey. (2006). <i>Microsoft office Excel 2007 for dummies</i>. For Dummies.</p> <p>Guy Hart-D Eavis. (2007). <i>How to do everything with Microsoft office word 2007</i>. Mac Graw-Hillprofessional.</p> <p>Louis Rosenblatt. (2010). <i>Rethinking the Way We Teach Science: The Interplay of Content, Pedagogy and the Nature of Science</i>. Taylor &amp; Francis.</p> <p><i>National Science Education Standards: observe, interact, change, learn, manual</i>. (1996). Nationalresearch council, National Academics Press.</p> <p>Raja Dan, Durga., Kash. U. (1982). <i>A Study of the International Influences in Functional Content oncurriculum Programme</i>.</p> <p>Taba, Hilda. (1962). <i>Curriculum Development, Theory and Practice</i>, Harcouort Brace and World Inc.</p> <p>Vijaya Kohli. (1992). <i>How to teach science: a treatise on methodology of teaching physics, chemistry andbiology</i>, Vivek Publishers.</p> <p>W. Joseph, Habraken. (2004). <i>Microsoft office 2003, All in one</i>, Que publishing.</p>	
Name of the Course Teacher:Dr. T. Sathiamoorthi	

Semester - II		
Course code: 517201	Applied Microbiology	Credits:4
<b>Unit –I</b>		
<b>Objective 1</b>	<b>Acquire knowledge on purification of water</b>	
<p><b>Mineral water industry:</b> Stages of mineral water production. Analysis of water quality – pH, salinity, alkalinity, dissolved oxygen, carbonates, nitrate, silicate, phosphate, COD and BOD. Determination of microbial load in water : <b>Faecal indicator organisms</b> - coliform bacteria, faecal enterococci, <i>Clostridium perfringens</i>, yeast, mould and sulphide reducing anaerobes, viruses and bacteriophages, fungi and yeasts, protozoa and helminths. <b>Methods of mineral water quality assessment</b> – MPN test, membrane filtration technique.</p>		
<b>Outcome 1</b>	<b>Determine the water quality assessment</b>	
<b>Unit-II</b>		
<b>Objective 2</b>	<b>Discuss the Preservation of pharmaceutical Products</b>	
<p><b>Preservation of pharmaceutical Products:</b> Chemical preservatives – raw materials – equipment role of preservatives. <b>Finished product tests</b> – microbial enumeration test, tests for specified microorganisms. <b>Sterility testing</b> – antimicrobial effectiveness testing. Sterility assurance – biological indicators, sterilization validation process. Microbial risk assessment through HACCP plan.</p>		
<b>Outcome 2</b>	<b>Distinguish the Preservation of pharmaceutical Products</b>	
<b>Unit III</b>		
<b>Objective 3</b>	<b>Acquire knowledge on endotoxin test methods</b>	
<p><b>Endotoxin test methods</b> - gel clot assay, turbidometric assay and chromogenic methods. <b>Biological assays</b> - vitamin assay, antibiotic assay and mycoplasma testing. <b>Endotoxin activity</b> – risk assessment in parenterals manufacture – pyrogen test – depyrogenation methods.</p>		
<b>Outcome 3</b>	<b>Determine the endotoxin test methods</b>	
<b>Unit IV</b>		
<b>Objective 4</b>	<b>Acquire knowledge on Rapid methods for detection of microorganisms in food</b>	
<p><b>Rapid methods for detection of microorganisms in food</b> – conventional and automated. Application of light pulse technology – principles of light pulse generation, mode of action, equipments, application of light pulses, effect of light pulses on foods and microorganisms, advantage and limitation of light pulse treatment. Quality control in fruits and vegetable processing. Risk assessment in food industry – physical, chemical and biological hazards</p>		
<b>Outcome 4</b>	<b>Discuss about Rapid methods for detection of microorganisms in food</b>	

<b>Unit V</b>	
<b>Objective 5</b>	<b>Acquire knowledge on assessment of microbial quality of marine foods</b>
<p><b>Assessment of microbial quality of marine foods:</b> Conventional and recent development methods – flow cytometry, ATP estimation, radiometric, reflective colorimetry, LAL test, immunoassay, DNA based and microarray methods. Application of additives in food. Food safety and standard act for adulteration. Significance of barcode and its uses in food industry.</p>	
<b>Outcome 5</b>	<b>To understand about the assessment of microbial quality of marine foods</b>
<p><b>Suggested Readings:</b></p> <p>Aneja, K.N. (2018). <i>Modern Food Microbiology</i>, Medtec Publisher.</p> <p>Bhatnagar, R. (2017). <i>Food Microbiology</i>, Crescent Publishing Corporation</p> <p>Carlberg, D.M. (2004). <i>Cleanroom Microbiology for the Non-Microbiologist</i> (2<sup>nd</sup> ed). CRC Press.</p> <p>Clontz, L. (2008). <i>Microbial Limit and Bioburden Tests: Validation Approaches and Global Requirements</i> (2<sup>nd</sup> ed). CRC Press.</p> <p>Plummer, D.T. (2003). <i>An Introduction of practical biochemistry</i> (3<sup>rd</sup> ed). New Delhi: Tata McGrawHill Publishing Company Ltd.</p> <p>Prince, R. (2008). <i>Microbiology in Pharmaceutical Manufacturing</i> Volume 1 (2<sup>nd</sup> ed, Revised and Expanded) Parenteral Drug Association and Davis Healthcare International Publishing.</p> <p>Trivedi, R. (2016). <i>Practical Mannual in Microbial Physiology and Industrial Microbiology</i>. New DelhiSSDN Publishers.</p> <p>Trivedy, R.K., Goel, P.K. and Trishal, C.L. (1987). <i>Practical methods in Ecology and Environmental science</i>, Environmental publishers.</p> <p>Williams, K.L. (2004). <i>Microbial Contamination Control in Parenteral Manufacturing</i>. New York:Marcel Dekker, Inc.</p> <p>Williams, K.L. (2007). <i>Endotoxins: Pyrogens, LAL Testing and Depyrogenation</i> (3<sup>rd</sup> ed.). CRC Press.</p>	
Name of the Course Teacher: Dr. A. Arun	

## Semester II

**Core V : Project Work**

**Maximum Marks: 200**

**Code : 517999**

**Thesis mark : 150**

**Credit : 8**

**Viva mark : 50**

<b>Name of Course Teacher</b>	<b>Research supervisor of the M.Phil candidate</b>
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## SCIENCE CAMPUS