



# **SOURASHTRA COLLEGE, MADURAI – 625004**

(An Autonomous Institution Re – accredited with 'B+' grade by NAAC)

## **B.Sc. MICROBIOLOGY – SYLLABUS**

**(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)**

1

### **ABOUT THE DEPARTMENT**

The Undergraduate Microbiology Programme was started in the year 1994. Since its inception, the department has been successfully offering courses leading to UG and PG degrees. The goal of the course is to give students scientific education and hands – on training in the field of microbiology, as well as to equip them with the required knowledge to meet the most recent demonstrations in the field. Ever since its inception, the department has been constantly concentrating on staying updated with the latest developments. The Department has well equipped laboratory and library to cater to the requirements of the Syllabi. The Department has produced eminent microbiologists who are working in various fields like Research, Pharma, Food Industries, Water – treatment plants and Academic sectors. All the graduates and postgraduates of the Department have been well placed in the various fields of Microbiology. The Department offers undergraduate programme in Microbiology (B.Sc. – Microbiology) and postgraduate programme in Microbiology (M.Sc. – Microbiology)

### **VISION**

To disseminate knowledge on the theoretical and practical aspects of applied microbiology, which is essential for the development of scientific research in the country.

### **MISSION**

- To impart knowledge and training across different fields of microbiology and to equip students for academic and industry careers.
- The programs are designed to enhance students' understanding of current research in different areas of microbiology and to bring them up to speed with the latest state – of – the – art in their field of interest.
- The department is equipped with all the necessary facilities to conduct basic research in the diverse areas of specialty of its faculty members.

### **OBJECTIVES**

- The objective of the course is to produce eminent Microbiologists for the society by imparting a deep and thorough knowledge on various fields of Microbiology, with hands – on – training and to achieve their dream carrier. Students are well – trained to have a vast knowledge of the subject from basic to advance levels using updated syllabi that match the current status of the subject.



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2

### **GRADUATE ATTRIBUTES**

1. **(KB) A knowledge base for microbiology:** Demonstrated competence in university level mathematics, natural sciences, microbiology fundamentals, and specialized microbiology knowledge appropriate to the program.
2. **(PA) Problem analysis:** An ability to use appropriate knowledge and skills to identify, formulate, analyze, and solve complex engineering problems in order to reach substantiated conclusions
3. **(Inv.) Investigation:** An ability to conduct investigations of complex problems by methods that include appropriate experiments, analysis and interpretation of data and synthesis of information in order to reach valid conclusions.
4. **(Des.) Design:** An ability to design solutions for complex, open – ended engineering problems and to design systems, components or processes that meet specified needs with appropriate attention to health and safety risks, applicable standards, and economic, environmental, cultural and societal considerations.
5. **(Tools) Use of microbiology equipments:** An ability to create, select, apply, adapt, and extend appropriate techniques, resources, and modern microbiology tools to a range of lab activities, from simple to complex, with an understanding of the associated limitations.
6. **(Team) Individual and teamwork:** An ability to work effectively as a member and leader in teams, preferably in a multi – disciplinary setting.
7. **(Comm.) Communication skills:** An ability to communicate complex engineering concepts within the profession and with society at large. Such ability includes reading, writing, speaking and listening, and the ability to comprehend and write effective reports and design documentation, and to give and effectively respond to clear instructions.
8. **(Prof.) Professionalism:** An understanding of the roles and responsibilities of the professional microbiologist in society, especially the primary role of protection of the public and the public interest.
9. **(Impacts) Impact of microbiology on society and the environment:** An ability to analyze social and environmental aspects of biological activities. Such ability includes an understanding of the interactions that microbiology has with the economic, social, health, safety, legal, and cultural aspects of society, the uncertainties in the prediction of such interactions; and the concepts of sustainable design and development and environmental stewardship.
10. **(Ethics) Ethics and equity:** An ability to apply professional ethics, accountability, and equity.
11. **(Econ.) Economics and project management:** An ability to appropriately incorporate economics and business practices including project, risk, and change management into the practice of engineering and to understand their limitations.
12. **(LL) Life – long learning:** An ability to identify and to address their own educational needs in a changing world in ways sufficient to maintain their competence and to allow them to contribute to the advancement of knowledge



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3

### PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

The Programme Educational Objectives of the **B.Sc. Microbiology** programme at Sourashtra College, Madurai are given below and are numbered from PEO1 to PEO6.

<b>PEO1</b>	To endow with the students the knowledge in microbiology and an outline of the processes that deal with microbes.
<b>PEO2</b>	To train the students by teaching the skills to use technical developments related to current areas involving molecular biology, immunology, microbiology, molecular genetics and genetic engineering with the scope of versatility in all potential future technologies.
<b>PEO3</b>	To guide the students to prefer a decent career option both as Entrepreneur and with a high degree of employability or pursue higher education by empowering them with technical skills.
<b>PEO4</b>	To impart a robust sense of communal accountability among the students with awareness of professional, societal and ethical values with leadership capabilities.
<b>PEO5</b>	To ascertain a milieu amidst the students that emphasizes the necessity to accomplish life – long learning for the general progress of self and society.
<b>PEO6</b>	To be aware of microbiological applications with progress of aptitude on par with global standards.

### UNDERGRADUATE (UG) PROGRAMME OUTCOMES (POs)

Undergraduate **B.Sc. – Microbiology** is a 3 – year degree Programme with 6 semesters consisting the following Programme Outcomes (POs) under various criteria including critical thinking, problem solving, effective communication, societal / citizenship / ethical credibility, sustainable growth and employable abilities.

<b>PO 1</b>	<b>Critical Thinking:</b> Intellectual exploration of knowledge towards actions in clear and rational manner by understanding the logical connections between ideas and decisions.
<b>PO 2</b>	<b>Problem Solving:</b> Understanding the task/ problem followed by planning and narrow execution strategy that effectively provides the solution.
<b>PO 3</b>	<b>Effective Communication:</b> Knowledge dissemination by oral and verbal mechanisms to the various components of our society.
<b>PO 4</b>	<b>Societal/ Citizenship/ Ethical Credibility:</b> Realization of various value systems/ moral dimensions and demonstrate the empathetic social concern as well as equity in all the decisions, executions and actions.
<b>PO 5</b>	<b>Environmental Concern and Sustainable Growth:</b> Understanding the emerging environmental challenges and provides the possible contribution in sustainable development that integrates environment, economy and employment.
<b>PO 6</b>	<b>Skill Development and Employable Abilities:</b> Adequate training in relevant skill sector and creating employable abilities among the under graduates.



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4

### PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of **B.Sc. Microbiology Programme**, the students are expected / will be able to

<b>PSO 1</b>	explore the biological diversity of microbial forms and various aspects of basic microbiology and able to address broad range of fields such as microbial taxonomy, microbial genetics, molecular biology, biocontrol, biochemistry, food and industrial microbiology and systems biology.
<b>PSO 2</b>	understand the microbial metabolism, concepts of molecular biology, microbial pathogenicity and the role of microorganisms in the human welfare and helps to address the specific solutions for the problems associated with human society.
<b>PSO 3</b>	develop high proficiency in good laboratory practices in microbiological laboratory and able to explain the theoretical basis and practical skills of the tools and techniques common to microbiology.
<b>PSO 4</b>	innovate and develop the skills necessary for effective communication of experimental results and scientific principles with the community related to microbiology field and non – microbiology fields.
<b>PSO 5</b>	acquire skills, assess and approach with ethical principles in the current social health issues and the ability to participate in a team.
<b>PSO 6</b>	develop employability skills in the various fields of microbiology and ability to engage in life – long learning on life skills.

### **DISTRIBUTION OF CREDITS (B.Sc. MICROBIOLOGY PROGRAMME)**

PART	SEM	COURSES	NO. OF COURSES	HOURS	CREDITS	TOTAL CREDITS
<b>I</b>	<b>I – IV</b>	<b>LANGUAGE</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>12</b>
<b>II</b>	<b>I – IV</b>	<b>ENGLISH</b>	<b>4</b>	<b>6</b>	<b>3</b>	<b>12</b>
<b>III</b>	<b>I – VI</b>	<b>CORE</b>	<b>15</b>	<b>4 – 5</b>	<b>4</b>	<b>60</b>
<b>III</b>	<b>I – IV</b>	<b>ALLIED</b>	<b>6</b>	<b>4</b>	<b>4</b>	<b>24</b>
<b>III</b>	<b>V – VI</b>	<b>ELECTIVE</b>	<b>3</b>	<b>5</b>	<b>5</b>	<b>15</b>
<b>IV</b>	<b>I – IV</b>	<b>SKILL BASED SUBJECT</b>	<b>6</b>	<b>2</b>	<b>2</b>	<b>12</b>
<b>IV</b>	<b>I</b>	<b>VALUE EDUCATION</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>IV</b>	<b>I</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>1</b>	<b>2</b>	<b>2</b>	<b>2</b>
<b>IV</b>	<b>III, IV</b>	<b>NON MAJOR ELECTIVE</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>4</b>
<b>V</b>	<b>IV</b>	<b>EXTENSION ACTIVITY</b>	<b>1</b>	<b>0</b>	<b>1</b>	<b>1</b>
	<b>V</b>	<b>SELF – STUDY (SOFT SKILLS)</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>
	<b>VI</b>	<b>SELF –STUDY (G.K. (ONLINE))</b>	<b>1</b>	<b>0</b>	<b>0</b>	<b>0</b>
<b>TOTAL</b>						<b>144</b>
<b>Any online courses in SWAYAM PORTAL</b>						



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5

### B.Sc. MICROBIOLOGY – COURSE STRUCTURE SEMESTER – I

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT11	<b>Part – I: Tamil –</b> பொதுத் தமிழ் – I	6	3	25	75	100	3
	24UACH11	<b>Hindi – General Hindi – I</b>						
	24UACS11	<b>Sanskrit – Poetry, Grammar and History of Sanskrit Literature</b>						
2.	24UACE11	<b>Part – II: English –</b> General English – I	6	3	25	75	100	3
3.	24UMBC11	<b>Part – III: Core – 1:</b> Fundamentals of Microbiology and Microbial Diversity	5	3	25	75	100	4
4.	24UMBCP1	<b>Part – III: Core Practical – I:</b> Lab in Fundamentals of Microbiology*	3	–	–	–	–	–
5.	24UMBA11	<b>Part – III: Allied – 1:</b> General Chemistry	4	3	25	75	100	4
6.	24UMBAP1	<b>Part – III: Allied Practical – I:</b> Volumetric Analysis*	2	–	–	–	–	–
7.	24UMBS11	<b>Part – IV: SBS – 1:</b> Microbial Techniques	2	3	25	75	100	2
8.	24UACVE1	<b>Part – IV: Value Education</b>	2	3	25	75	100	2
		<b>TOTAL</b>	30				600	18

\*Practical Examinations at the end of the II Semester

### SEMESTER – II

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT21	<b>Part – I: Tamil –</b> பொதுத் தமிழ் – II	6	3	25	75	100	3
	24UACH21	<b>Hindi – General Hindi – II</b>						
	24UACS21	<b>Sanskrit – Prose, Grammar and History of Sanskrit Literature</b>						
2.	24UACE21	<b>Part – II: English –</b> General English – II	6	3	25	75	100	3
3.	24UMBC21	<b>Part – III: Core – 2:</b> Microbiology Physiology & Metabolism and Taxonomy	5	3	25	75	100	4
4.	24UMBCP1	<b>Part – III: Core Practical – I:</b> Lab in Fundamentals of Microbiology	3	3	40	60	100	4
5.	24UMBA21	<b>Part – III: Allied – 2:</b> Allied Chemistry for Life Sciences	4	3	25	75	100	4
6.	24UMBAP1	<b>Part – III: Allied Practical – I:</b> Volumetric Analysis*	2	3	40	60	100	4
7.	24UMBS21	<b>Part – IV: SBS – 2:</b> Diagnostic Microbiology and Haematology	2	3	25	75	100	2
8.	24UACES1	<b>Part – IV: Environmental Studies</b>	2	3	25	75	100	2
		<b>TOTAL</b>	30				800	26

Passed in the BoS Meeting held on 09/03/2024

Signature of the Chairman



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6

### SEMESTER – III

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – I: Tamil – காப்பியமும் நாடகமும்	6	3	25	75	100	3
		Hindi – Hindi – III						
		Sanskrit – Sanskrit – III						
2.		Part – II: English – English For Enrichment – III	6	3	25	75	100	3
3.		Part – III: Core – 3: Molecular Microbiology	5	3	25	75	100	4
4.		Part – III: Core Practical – II: Lab in Molecular Microbiology*	3	–	–	–	–	–
5.		Part – III: Allied – 3: Cell Biology	4	3	25	75	100	4
6.		Part – III: Allied Practical – II : Cell Biology and Biodiversity*	2	–	–	–	–	–
7.		Part – IV: SBS – 3: Mushroom Technology	2	3	25	75	100	2
8.		Part – IV: NME–1: Food and Dairy Technology	2	3	25	75	100	2
		<b>TOTAL</b>	<b>30</b>				<b>600</b>	<b>18</b>

\*Practical Examinations at the end of the IV Semester

### SEMESTER – IV

S. No.	Course Code	Course Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		Part – I: Tamil – சங்க இலக்கியமும் அற இலக்கியமும்	6	3	25	75	100	3
		Hindi – Hindi – III						
		Sanskrit – Sanskrit – III						
2.		Part – II: English – III –	6	3	25	75	100	3
3.		Part – III : Core 4: Microbial Genetics	5	3	25	75	100	4
4.		Part – III: Core Practical – II: Lab in Molecular Microbiology*	3	3	40	60	100	4
5.		Part – III: Allied – 4: Biodiversity and Biostatistics	4	3	25	75	100	4
6.		Part – III: Allied Practical – II : Cell Biology and Biodiversity*	2	3	40	60	100	4
7.		Part – IV: SBS – 4: Cosmetic Microbiology	2	3	25	75	100	2
8.		Part – IV: NME – 2: Microbes in Human Health	2	3	25	75	100	2
9.		Part – V: Extension Activities	–	–	–	–	100	1
		<b>TOTAL</b>	<b>30</b>				<b>600</b>	<b>27</b>

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7

### SEMESTER – V

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		<b>Part – III: Core – 5:</b> Clinical Microbiology	5	3	25	75	100	4
2.		<b>Part – III: Core – 6:</b> Agricultural and Environmental Microbiology	4	3	25	75	100	4
3.		<b>Part – III: Core – 7:</b> Immunology	4	3	25	75	100	4
4.		<b>Part – III: Core – 8:</b> Food and Industrial Microbiology	5	3	25	75	100	4
5.		<b>Part – III: Core Practical – III : Lab in Applied Microbiology &amp; Immunology</b>	5	3	40	60	100	4
6.	<b>Part – III: Elective – 1:</b>		5	3	25	75	100	5
		Computer Applications in Biology						
		Bioremediation						
		Fermentation and Bioprocess Technology						
7.		<b>Part – IV: SBS – 5:</b> Biocontrol	2	3	25	75	100	2
8.		Soft Skills (Self–Study)	–	–	–	–	100	–
		<b>TOTAL</b>	<b>30</b>				<b>800</b>	<b>27</b>

\*One elective course to be chosen from THREE courses



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8

### SEMESTER – VI

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.		<b>Part – III: Core – 9:</b> Virology	4	3	25	75	100	4
2.		<b>Part – III: Core – 10:</b> Biochemistry and Enzymology	5	3	25	75	100	4
3.		<b>Part – III: Core – 11:</b> rDNA Technology	4	3	25	75	100	4
4.		<b>Part – III: Core Practical – IV: Lab in Biochemistry and rDNA Technology</b>	5	3	40	60	100	4
5.	<b>Part – III: Elective – 2:</b>		5	3	25	75	100	5
		Bioinformatics						
		Biotechnology						
		IPR, Bioethics and Biosafety						
6.	<b>Part – III: Elective – 3:</b>		5	3	25	75	100	5
		Analytical Microbiology						
		Mycology						
		Parasitology						
7.		<b>Part – IV: SBS – 6:</b> Pharmaceutical Microbiology	2	3	25	75	100	2
8.		General Knowledge (Self–Study)	–	–	–	–	100	–
		<b>TOTAL</b>	<b>30</b>				<b>800</b>	<b>28</b>

\*One elective course to be chosen from THREE courses





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9

### COURSE STRUCTURE – I SEMESTER

#### SEMESTER – I

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT11	<b>Part – I: Tamil –</b> பொதுத் தமிழ் – I	6	3	25	75	100	3
	24UACH11	<b>Hindi –</b> General Hindi – I						
	24UACS11	<b>Sanskrit –</b> Poetry, Grammar and History of Sanskrit Literature						
2.	24UACE11	<b>Part – II: English –</b> General English – I	6	3	25	75	100	3
3.	24UMBC11	<b>Part – III: Core – 1:</b> Fundamentals of Microbiology and Microbial Diversity	5	3	25	75	100	4
4.	24UMBPC1	<b>Part – III: Core Practical – I:</b> Lab in Fundamentals of Microbiology*	3	–	–	–	–	–
5.	24UMBA11	<b>Part – III: Allied – 1:</b> General Chemistry	4	3	25	75	100	4
6.	24UMBAP1	<b>Part – III: Allied Practical – I:</b> Volumetric Analysis*	2	–	–	–	–	–
7.	24UMBS11	<b>Part – IV: SBS – 1:</b> Microbial Techniques	2	3	25	75	100	2
8.	24UACVE1	<b>Part – IV:</b> Value Education	2	3	25	75	100	2
		<b>TOTAL</b>	30				600	18

\*Practical Examinations at the end of the II Semester

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

NME – Non –Major Elective

T – Theory

P – Practical

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10

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBC11	FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY	CORE – 1	5	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course focuses on the general principles of microbiology providing students with an understanding of the fundamental concepts of the biology of microorganisms.

### COURSE OBJECTIVES:

- To inculcate the knowledge on the basics of microbiology.
- To help the students recognise the principles of microscopy.
- To make the students acquire the acquaintance on diversity of microorganisms and structural features of microbes.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	acquire the knowledge on the basic concepts, scope and development of microbiology.	Upto K3
CO 2	understand the principles of microscopy and different types of microscope & its applications.	Upto K3
CO 3	gain the knowledge on the structural organization of bacteria; analyse the differences between the structural organization of prokaryotes and eukaryotes.	Upto K3
CO 4	obtain the knowledge on the structural features and life cycle of algae and fungi.	Upto K3
CO 5	acquire the familiarity on the essential facets of bacteria and virus.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY

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11

### **FUNDAMENTALS OF MICROBIOLOGY AND MICROBIAL DIVERSITY**

#### **UNIT – I:**

Introduction, Definition, scope and history of Microbiology; Theory of Abiogenesis, Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Edward Jenner, Joseph Lister, Elie Metchnikoff, Paul Ehrlich, Alexander Fleming, Waksman, Beijerinck, James Watson and Francis Crick. Role of microorganisms in fermentation, Germ theory of disease, Development of various microbiological techniques and golden era of microbiology

#### **UNIT – II:**

Microscopy : instrumentation & principle – (Magnification, Numerical aperture, Resolving power, contrast); Types of Microscopy – Compound, Light and Dark field Microscope, Phase Contrast Microscope, Fluorescent Microscope, Electron Microscope – Scanning and Transmission Electron Microscope.

#### **UNIT – III:**

Cell structure and sub cellular organelles of bacteria – Slime layer, capsule, cell wall, flagella, pili, fimbriae, nucleoid, plasmid and episome (F, R, Ti as example) ribosome, cytoplasmic inclusions, endospore (*Bacillus subtilis*) structure.

#### **UNIT – IV:**

Characteristic features of Algae – Structure and reproduction of *Chlorella*, *Euglena*, *Chlamydomonas* and Diatoms; Characteristic features of Fungi – Structure and reproduction of *Saccharomyces* sp., *Aspergillus* and *Penicillium* sp.

#### **UNIT – V:**

Characteristic features of virus; structure of TMV, poliovirus, T4 and  $\lambda$  phage, lytic and lysogenic cycles, one step multiplication curve

#### **TEXT BOOKS:**

1. Pelczar, M.J., Chan, E.C.S and Kreig, N.R. 1993. *Microbiology*. Tata McGraw Hill Publishing Co., Ltd., New Delhi.
2. Sullia S. B and Santharam S., , 2000 Ed., *General Microbiology* Oxford and IBH Publishing Co., Pvt., Ltd.
3. Dr. Dubey R.C and Dr. Maheshwari. 2016, D.K. A *Text Book of Microbiology*, Revised Edition, S. Chand & Company Ltd.
4. Ananthanarayanan and Paniker's, 2022, *A Text of Microbiology*, 12<sup>th</sup> Edition, Unibversity Press.
5. Alexopoulos C. J., Mims C. W and Blackwell.M, 4<sup>rd</sup> Ed. *Introductory Mycology*, 2007, Wiley Eastern Publications.



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12

### REFERENCE BOOKS:

1. Prescott, Joanne Willy, Kathleen Sandman and Dorothy Wood, 11<sup>th</sup> Ed., 2019, *Microbiology*, Tata McGraw Hills.
2. Hans G Schlegel, 7<sup>th</sup> Edition, 2017, *General Microbiology*, Cambridge University Press.
3. Schlegel H. G., 6<sup>th</sup> Ed., 1993, *General Microbiology*, Tata McGraw Hill Publications.
4. Cynthia Nau Cornelissen, Marcia Metzgar Hobbs, SAE Editors: Sumathi Muralidhar, Rohit Chawla. 2019, *Illustrated Revirews*, South Asian Edition.
5. Jacquelyn G. Black, Laura J. Black, 10<sup>th</sup> Edition, 2017, *Microbiology Principles and Explorations*, 10<sup>th</sup> Edition, 2017, Wiley publications.

### DIGITAL TOOLS:

1. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7176178/>
2. [https://www.eolss.net/sample\\_chapters/c03/e6\\_51\\_04\\_01.pdf](https://www.eolss.net/sample_chapters/c03/e6_51_04_01.pdf)
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4275845/>
4. <https://onlinelibrary.wiley.com/doi/abs/10.1002/9781118960608.cbm00019>
5. <https://testbook.com/biology/chlorella>

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	1	3
CO2	3	3	3	2	1	1
CO3	3	1	1	2	1	2
CO4	2	1	2	1	1	2
CO5	2	1	3	1	1	1

3. Advanced Application    2. Intermediate Development    1. Introductory Level

**COURSE DESIGNER: Dr. K. RAGHAVAN and Dr. V. SELVI**



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

13

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBCP1	LAB IN FUNDAMENTALS OF MICROBIOLOGY	CORE PRACTICAL – I	–	3	-

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	-	-	-

NATURE OF COURSE	Employability	Skill Oriented	Entrepreneurship
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

### COURSE DESCRIPTION:

This course has been designed to provide the fundamental knowledge on basic microbiology to help the students understand the requirements of microbial growth and its control.

### COURSE OBJECTIVES

- To make the students comprehend the knowledge of practical applications in the field of basic microbiology.
- To make the students acquire the expertise on isolation and characterization of microbes.
- To make the students obtain the cognizance on principles of sterilization and its impact on microbial growth.

### COURSE OUTCOMES (COs)

After the completion of the course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	learn the aspects of sterilization techniques	Upto K3
CO 2	gain knowledge on microbiological media preparation and staining techniques.	Upto K3
CO 3	acquire awareness on microbial isolation and identification.	Upto K3
CO 4	realise the significance of biochemical characterization of microbes.	Upto K3
CO 5	comprehend the principles of various staining techniques.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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## **B.Sc. MICROBIOLOGY – SYLLABUS**

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14

### **LAB IN FUNDAMENTALS OF MICROBIOLOGY**

#### **BASIC MICROBIOLOGY:**

1. Microbiology lab safety and precautions
2. Measurement of Cell size by Micrometry.
3. Sterilization techniques: Physical and Chemical methods.
4. Preparation of various microbiological media.
5. Pure culture techniques – Streak, Spread and Pour Plate methods.
6. Isolation and enumeration of bacteria from environmental samples.
7. Isolation and enumeration of fungi from environmental samples.
8. Observation of bacterial motility by Hanging drop Method.
9. Staining Techniques – Simple, Gram's Staining, Capsule Staining, Fungal Staining and Endospore Staining.

#### **MICROBIAL TAXONOMY:**

##### **A. Observation of microbial structures and characteristic features –**

###### **Demonstration:**

**Bacteria** : *E. coli, Bacillus, Clostridium*

**Algae** : *Chlorella, Euglena, Chlamydomonas, Diatoms.*

**Fungi** : *Rhizopus, Mucor, Aspergillus, Penicillium* and Yeast.

**Viruses** : T<sub>4</sub>, Lambda, HIV and TMV.

##### **B. Biochemical tests for bacterial identification:**

1. Carbohydrate fermentation and acid – gas production.
2. IMVIC tests.
3. Catalase test.
4. Oxidase test.
5. TSI.
6. Starch, Lipid and protein hydrolysis

##### **C. Microbial Physiology:**

Measurement of microbial cell count



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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

15

### TEXT BOOK:

Mukherjee, K.L., *Medical Laboratory Technology* Vol –I, III, Tata McGraw – Hill publishing company Ltd., New Delhi.

### REFERENCE BOOKS:

1. P. Gunasekaran. 2<sup>nd</sup> edition, 2018, *Laboratory Manual in Microbiology* by. New Age International (P) Ltd.
2. Cappuccino.Welsh.2017, *Microbiology A Laboratory Manual*. 11<sup>th</sup>Edition. Pearson Education.
3. James G. Cappuccino, Natalie Sherman1999 *Microbiology: A Laboratory Manual*, Benjamin/Cummings
4. Senthil kumar.B,2014.*Practical Microbiology – A Laboratory Manual*. Panima Publishing Corporation, New Delhi, India.
5. Kannan. First Edition. 1996. *Laboratory Manual in General Microbiology*, Palani Paramount Publications.

### DIGITAL TOOLS:

1. <https://guides.baker.edu/c.php?g=303096&p=2028580>
2. <https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson – 11.pdf>
3. <https://courseware.cutm.ac.in/wp – content/uploads/2020/05/Micrometer.pdf>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846335/>
5. <https://microbialnotes.com/motility – test – by – using – hanging – drop – method – explained>

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	3	3
CO2	3	1	3	3	3	3
CO3	3	3	2	3	3	3
CO4	2	3	2	1	2	2
CO5	2	3	3	3	3	3

3. Advanced Application      2. Intermediate Development      1. Introductory Level

**COURSE DESIGNER: Dr. K. RAGHAVAN and Dr. V. SELVI**



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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

16

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBA11	GENERAL CHEMISTRY	ALLIED – 1	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course introduces the fundamentals of atomic structure, delves into the theories of atomic connections utilizing the periodic table, and provides a comprehensive understanding of diverse bond types. Furthermore, it covers essential aspects of organic chemistry, solutions and surface chemistry to build a solid knowledge base in these areas.

### COURSE OBJECTIVES:

This course aims to

- Give insight into the structural composition of atoms.
- Explore the diverse spectrum of bond types in chemistry.
- Study about the basic concepts in organic chemistry.
- Develop a foundational understanding of solutions.
- Investigate the fundamental principles underlying surface chemistry.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	explore the foundational principles of atoms and elucidate the periodic trends observed among elements within the periodic table.	Upto K3
CO 2	analyse the types of chemical bonding.	Upto K3
CO 3	gain a comprehensive understand the fundamental concepts in organic chemistry.	Upto K3
CO 4	categorize and understand various concepts in solutions.	Upto K3
CO 5	gain the knowledge of catalysis and adsorption.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY





# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with 'B+' grade by NAAC)

## **B.Sc. MICROBIOLOGY – SYLLABUS**

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

17

### GENERAL CHEMISTRY

#### **UNIT – I: Atomic Structure and Periodic Trends: [12 Hrs]**

Constituents of atom – atomic number – mass number – isotopes – isobars – shapes of orbitals – quantum numbers – Aufbau principle – Hund's rule – Pauli's exclusion principle – electronic configuration of atoms – salient features of modern periodic table. Atomic radii, Covalent radii, Electron affinity, Electronegativity (Definition and its trends).

#### **UNIT – II: Chemical Bonding: [12 Hrs]**

Ionic, covalent, polar covalent and coordinate bonds (definition, characteristics and examples) – Intermolecular forces: van der Waals forces – dipole – dipole, dipole – induced dipole, induced dipole – induced dipole interactions – Hydrogen bonding: definition, conditions for formation, types and characteristics of hydrogen bonded compounds.

#### **UNIT – III: Fundamental Concepts in Organic Chemistry: [12Hrs]**

a) Nature of valency of carbon in organic compounds – tetrahedral arrangements of carbon – bond breaking and bond forming in organic reactions – homolytic cleavage – heterolytic cleavage – reaction intermediates – formation and stability of carbocations, carbanions and free radicals.

b) Reagents: Nucleophilic and electrophilic – types and examples.

c) Types of organic reactions: addition, substitution, elimination, rearrangement and polymerization (examples only).

#### **UNIT – IV: Solutions: [12 Hrs]**

Definition – types of solutions – concentration – solute – solvent – molecular weight – equivalent weight – various ways of expressing concentration of solutions: molarity, molality, normality, formality, mole fraction, ppm, w/w, w/v, v/v (problems involving direct substitution only) – osmosis and its applications – isotonic solutions and its biological importance – hypertonic and hypotonic solutions – reverse osmosis and its applications.

#### **UNIT – V: Surface Chemistry: [12 Hrs]**

a) **Catalysis:** Definition – general characteristics of catalytic reactions – types of catalyst (positive and negative) – types of catalysis (homogeneous and heterogeneous) – acid – base catalysis – auto – catalysis – enzyme catalysis – catalytic promoters – catalytic poisons – theories of catalysis.

b) **Adsorption:** Definition – various terms involve in adsorption – types of adsorptions – physical and chemical adsorption – factors influencing adsorption – applications of adsorption.



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(An Autonomous Institution Re – accredited with 'B+' grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

18

### TEXT BOOKS:

1. *Principles of Physical Chemistry* by B.R. Puri, L.R. Sharma and S. Pathania – Vishal Publishing Co. 43<sup>rd</sup> Edn. (2022)
2. *Principles of Inorganic Chemistry* by Puri, Sharma & K.C. Kalia, Milestone publishers, 48<sup>th</sup> Edn. (2019).
3. *Modern Organic Chemistry* by M. K. Jain and S. C. Sharma – Vishal Publishing Co. 4th Edn. (2014).

### REFERENCE BOOKS:

1. *Modern Inorganic Chemistry* by R.D. Madan, S. Chand and Co. Ltd. (2012).
2. *Essentials of Physical Chemistry* by B. S. Bahl, Arun Bahl and G. D. Tuli, S. Chand and Co. Ltd. (2016).
3. *A Text book of Organic Chemistry* by B. S. Bahl, Arun Bahl and G. D. Tuli, S. Chand and Co. Ltd. (2019).

### DIGITAL TOOLS:

1. <https://youtu.be/hePb00CqvP0?si=Y9tTImddawf2CB0p>  
[https://youtu.be/7cEtOHLZQ2A?si=bpxv\\_mGoqFDYKYGM](https://youtu.be/7cEtOHLZQ2A?si=bpxv_mGoqFDYKYGM)
2. <https://youtu.be/PoQjsnQmxok?si=9koWqAmitFuw8ljG>
3. [https://www.youtube.com/watch?v=B\\_ketdzJtY8](https://www.youtube.com/watch?v=B_ketdzJtY8)
4. [https://youtube.com/shorts/S53WAct\\_m3o?si=IGvhho\\_8jgrRO6mJ](https://youtube.com/shorts/S53WAct_m3o?si=IGvhho_8jgrRO6mJ)
5. [https://youtu.be/knu5pyLHmsI?si=NI\\_D3EN0u0jL1kDz](https://youtu.be/knu5pyLHmsI?si=NI_D3EN0u0jL1kDz)

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	1	3	1	2
CO2	3	3	1	2	1	2
CO3	3	3	3	3	3	2
CO4	3	3	3	3	3	2
CO5	3	3	3	3	3	1

3. Advanced Application      2. Intermediate Development      1. Introductory Level

**COURSE DESIGNER: Dr. T. S. MANIKANDAN**



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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

19

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBAP1	VOLUMETRIC ANALYSIS	ALLIED PRACTICAL – I	-	2	-

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course gives the practical knowledge in volumetric analysis.

### COURSE OBJECTIVE:

A double titration involving the making up of the solution to be estimated and the preparation of primary standard solutions.

### COURSE OUTCOMES (CO):

After the completion of the Course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO	illustrate the estimation of substance by various types of titration method	Upto K3

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard Solution



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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

20

### VOLUMETRIC ANALYSIS

#### LIST OF EXPERIEMENTS:

##### 1. ACIDMETRY AND ALKALIMETRY

1. Titration between a strong acid and strong base
2. Titration between a strong acid and weak base
3. Titration between a weak acid and strong base

##### 2. PERMANGANOMETRY

4. Titration between potassium permanganate and oxalic acid
5. Titration between potassium permanganate and ferrous sulphate
6. Titration between potassium permanganate and Mohr's salt

##### 3. EDTA TITRATIONS (DEMONSTRATION ONLY)

7. Estimation of  $Ca^{2+}$  ions in water using EDTA
8. Estimation of  $Mg^{2+}$  ions in water using EDTA

#### Summative Examination at the end of semester II

Max. marks – 100

Distribution of Marks: Internal – 40 Marks  
External – 60 Marks

Duration of Examination: 3 hrs

#### Internal

Class Experiments : 30 marks  
Observation note book : 10 marks  
Total : 40 marks

#### External examination

Record Notebook : 10 marks  
Procedure writing : 10 marks  
Experiment : 40 marks  
Total : 60 marks

For Estimation, if the student has

- < 2% error – 40 marks
- 2 – 3% error – 35 marks
- 3 – 4% error – 30 marks
- 4 – 5% error – 25 marks
- > 5% error – 15 marks

#### TEXT BOOK:

1. *Vogel's Textbook of Quantitative Inorganic Analysis* 4<sup>th</sup> Edn. (1978).

#### REFERENCE BOOK:

1. *Basic Principles of Practical chemistry* by V. Venkatheswaran, R. Veeraswamy and A. R. Kulandaivelu, 2<sup>nd</sup> Edn. S. Chand and Co. Ltd. (2015).

#### DIGITAL SOURCES:

1. <https://www.youtube.com/watch?v=V9tAQl2XcHw>
2. <https://www.youtube.com/watch?v=cEOvj6jkdDw>

#### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO	3	3	3	3	3	3

3. Advanced Application      2. Intermediate Development      1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN

Passed in the BoS Meeting held on 09/03/2024

Signature of the Chairman



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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

21

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBS11	MICROBIAL TECHNIQUES	SBS – 1	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	I	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course is designed to provide the requisite awareness on the focus of microbial techniques.

### COURSE OBJECTIVES:

- To illustrate the elementary techniques in microbiology.
- To make the students understand nutritional requirements of microbes.
- To help the students understand the microbial kinetics and its associated factors.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	understand the microbiological lab safety and aseptic techniques	Upto K3
CO 2	know about types of microbiological media	Upto K3
CO 3	comprehend the methods of bacterial cultivation.	Upto K3
CO 4	understand the process of the microbial growth	Upto K3
CO 5	acquire the knowledge on microbial culture preservation and maintenance.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

22

### **MICROBIAL TECHNIQUES**

#### **UNIT – I: Sterilization Techniques**

Microbiology Laboratory safety regulations; Sterilization methods – Physical – dry heat, moist heat, UV light, ionizing radiation, filtration – HEPA filter,; Chemical – disinfection – alcohol, phenol and formaldehyde & antiseptics (brief account only).

#### **UNIT – II: Culture Media**

Growth media – solid and liquid media. Components of culture media – Types – natural and synthetic media, chemically defined media, complex media, selective, differential and enriched media (Two examples each).

#### **UNIT – III: Isolation of Microorganisms and Pure Culture Techniques**

Streak plate, serial dilution, spread plate, pour plate, stab culture and slant culture. Anaerobic – thioglycolate, liquid shake culture of aerobic bacteria. Cultivation of fungi, Culture collection centres (any two – a brief account).

#### **UNIT – IV: Growth of Bacteria**

Definition, growth phases, measurement of growth phases – direct (viable counts) and indirect (metabolic activity, Most Probable Number, microscopic counts, electronic counters), Turbidity, factors affecting bacterial growth (pH, temperature, oxygen). Types of cultures – stock, batch, continuous and synchronous cultures (a brief account)

#### **UNIT – V: Preservation and Maintenance of Microbial Culture**

Methods – short term preservation (storage by drying method and deep freeze – 80° C, – 120° C, – 160° C) and long term preservation (Glycerol stock), Lyophilization and cryopreservation

#### **TEXT BOOKS:**

1. Mukherjee, K.L., Vol –I, III, *Medical Laboratory Technology*, Tata McGraw – Hill publishing company Ltd., New Delhi.
2. Ananthanarayanan.R., and JayaramPanicker,C.K.,2005,*Text book of Microbiology*, Orient Longman.
3. Pelczar, M.J.,Chan, E.C.S and Kreig ,N.R. 1993. *Microbiology*, Tata McGraw Hill Publishing Co., Ltd., New Delhi.
4. Dubey, *A text book of Microbiology*, 2016, Dr. Dubey R.C and Dr. Maheshwari. D.K. Revised Edition, S. Chand & Company Ltd.
5. *Microbiology an Introduction*, 14th Edition, Tortora, Case, Bair, Weber, Funke, Pearson.



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(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

23

### REFERENCE BOOK(S):

1. Jacquelyn G. Black, Laura J. Black, 10<sup>th</sup> Edition, 2017, *Microbiology Principles and Explorations*, Wiley Publications.
2. Roger Y Stanier, John L.Ingraham, Mark L.Wheelis and Page R.Painter. 5<sup>th</sup> Edition. 1995.*General Microbiology*. Macmillan.
3. Bailey & Scott’s, 15<sup>th</sup> Edition, 2021, *Diagnostic Microbiology*, Elseiver Health Sciences.
4. James Cappuccino, Chad Welsh, 2023, 11<sup>th</sup> Edition, *Microbiology: A Laboratory Manual*, Pearson Education, Elsevier.
5. Bender,Buckley, Sattley,Stahl, Madigan, 16th Edition, 2021, *Brock Biology of Microorganisms*, Pearson Education.

### DIGITAL TOOLS:

1. [https://krishi.icar.gov.in/jspui/bitstream/123456789/32533/1/2\\_Sterilization%20techniques.pdf](https://krishi.icar.gov.in/jspui/bitstream/123456789/32533/1/2_Sterilization%20techniques.pdf)<https://microbenotes.com/types-of-culture-media/>
2. <https://milnepublishing.geneseo.edu/suny-microbiology-lab/chapter/bacteriological-culture-methods/>
3. <https://conductscience.com/bacterial-growth/>
4. <file:///C:/Users/Admin/Downloads/ANALYZINGMICROBES.pdf>
5. [https://deogiricollege.org/iqau/science/biotech/pure\\_culture\\_techniques.pdf](https://deogiricollege.org/iqau/science/biotech/pure_culture_techniques.pdf)

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	1	3
CO2	3	3	3	2	1	3
CO3	3	1	1	2	1	2
CO4	2	1	2	1	1	2
CO5	2	1	3	1	1	1

3. Advanced Application    2. Intermediate Development    1. Introductory Level

**COURSE DESIGNER: Prof. N.B. SHARMILA**



# SOURASHTRA COLLEGE, MADURAI – 625004

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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

24

### COURSE STRUCTURE – II SEMESTER

S. No.	Course Code	Course Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	24UACT21	<b>Part – I: Tamil –</b> பொதுத் தமிழ் – II	6	3	25	75	100	3
	24UACH21	<b>Hindi –</b> General Hindi – II						
	24UACS21	<b>Sanskrit –</b> Prose, Grammar and History of Sanskrit Literature						
2.	24UACE21	<b>Part – II: English –</b> General English – II	6	3	25	75	100	3
3.	24UMBC21	<b>Part – III: Core – 2:</b> Microbiology Physiology & Metabolism and Taxonomy	5	3	25	75	100	4
4.	24UMBPC1	<b>Part – III:</b> <b>Core Practical – I:</b> Lab in Fundamentals of Microbiology	3	3	40	60	100	4
5.	24UMBA21	<b>Part – III: Allied – 2:</b> Allied Chemistry for Life Sciences	4	3	25	75	100	4
6.	24UMBAP1	<b>Part – III: Allied Practical – I:</b> Volumetric Analysis*	2	3	40	60	100	4
7.	24UMBS21	<b>Part – IV: SBS – 2:</b> Diagnostic Microbiology and Haematology	2	3	25	75	100	2
8.	24UACES1	<b>Part – IV:</b> Environmental Studies	2	3	25	75	100	2
		<b>TOTAL</b>	30				800	26

**CA** – Class Assessment (Internal)

**SE** – Summative Examination

**SBS** – Skill Based Subject

**NME** – Non –Major Elective

**T** – Theory

**P** – Practical

Passed in the BoS Meeting held on 09/03/2024

Signature of the Chairman





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## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

25

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBC21	MICROBIOLOGY PHYSIOLOGY & METABOLISM AND TAXONOMY	CORE – 2	5	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course is designed to inculcate the concepts of microbial metabolism with an elaborate coverage of the classification system of microorganisms.

### COURSE OBJECTIVES:

- To help the students develop an understanding of microbial metabolism, growth, and energy generation.
- To make the students gain knowledge of various fermentation pathways, microbial communication, and energetics.
- To familiarize the students with concepts of nitrogen and phosphate assimilation, electron transport chain, and transfer of genetic information among microbial communities.
- To help the students acquire familiarity on the concepts of microbial taxonomy.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	acquaint with the basics of generation of energy, entropy.	Upto K3
CO 2	understand the photosynthetic pathways and inorganic metabolism.	Upto K3
CO 3	identify the process of bacterial cell division and differentiation.	Upto K3
CO 4	obtain knowledge on characteristic features of microbial taxonomy	Upto K3
CO 5	gain familiarity on the classification of fungi, viruses, and algae.	Upto K3



# **SOURASHTRA COLLEGE, MADURAI – 625004**

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## **B.Sc. MICROBIOLOGY – SYLLABUS**

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

26

### **MICROBIOLOGY PHYSIOLOGY & METABOLISM AND TAXONOMY**

#### **UNIT – I:**

Generation of energy: entropy, Generation of ATP – Substrate Level Phosphorylation, Oxidative Phosphorylation, Proton motif force. Fermentation vs. Respiration pathways.

#### **UNIT – II:**

Photosynthesis and Inorganic Metabolism: Photosynthesis in bacteria – Electron Transport: Green bacteria, Cyanobacteria and Purple Photosynthetic bacteria. Inorganic metabolism in bacteria – Nitrogen, Phosphorous and Sulfur.

#### **UNIT – III:**

Bacterial Cell division and Differentiation: Sporulation in *Bacillus*: Endospore formation, activation, germination and outgrowth. Differentiation in *Caulobacter* and *Dictyostelium*.

#### **UNIT – IV:**

Taxonomy: Major characteristics features – Morphological, Physiological, biochemical, and Molecular characteristics and their role. Principles of Chemotaxonomy and Numerical taxonomy. Classification of Bacteria – Bergey’s classification.

#### **UNIT – V:**

Classification of fungi – Alexopolus and Mims, Classification of Algae – Fritsch’s, Classification of Viruses – Baltimore, Classification of Plant and animal viruses– Major families with suitable examples.

#### **TEXTBOOKS:**

1. Albert G. Moat John W. Foster and Michael P. Spector, 2003, 4<sup>th</sup> Edition, *Microbial Physiology*, Library of Congress Cataloguing in Publications.
2. S. Ram Reddy and S.M. Reddy, 2<sup>nd</sup> Edition, 2017, *Microbial Physiology*, Scientific Publishers.
3. Ashok Kumar Awasthi, 2015, *Text book of Algae*, Vikas Publishing House Ltd.
4. Robert K. Poole, David J. Kelly, 2023, *Advances in Microbial Physiology*, Scientific Publishers.
5. S Meena Kumari, 2019, *Microbial Physiology*,. MJP Publishers



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

27

### REFERENCE BOOKS:

1. Daniel R. Caldwell, *Microbial Physiology and Metabolism*, 2<sup>nd</sup> Edition. Library of Congress Cataloguing in Publications.
2. Alexopolus C. J and Mims C. W., *Introductory Mycology*, 3<sup>rd</sup> Ed., Wiley Eastern Publications
3. Bergey DH. 1994. *Bergey's manual of determinative bacteriology*. Lippincott Williams & Wilkins.
4. Raghukumar S, Raghukumar S. *Fungi: Characteristics and classification. Fungi in coastal and oceanic marine ecosystems*. Springer Publication.
5. Peter A.R. Vandamme, 2019, *Taxonomy and Classification of Bacteria*, Wiley Online Library.

### DIGITAL TOOLS:

1. [https://www.sciencedirect.com/topics/biochemistry – genetics – and – molecular – biology/substrate – level – phosphorylation](https://www.sciencedirect.com/topics/biochemistry-genetics-and-molecular-biology/substrate-level-phosphorylation)
2. <https://www.ncbi.nlm.nih.gov/books/NBK526105/>
3. [https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology\\_%28Boundless%29/06%3A\\_Culturing\\_Microorganisms/6.02%3A\\_Cell\\_Differentiation\\_and\\_Starvation/6.2D%3A\\_Bacterial\\_Differentiation](https://bio.libretexts.org/Bookshelves/Microbiology/Microbiology_%28Boundless%29/06%3A_Culturing_Microorganisms/6.02%3A_Cell_Differentiation_and_Starvation/6.2D%3A_Bacterial_Differentiation)
4. <https://www.biologyonline.com/dictionary/taxonomy>
5. [https://www.brainkart.com/article/Classification – of – Fungi\\_32853/#google\\_vignette](https://www.brainkart.com/article/Classification-of-Fungi_32853/#google_vignette)

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	1	3	1	2	1	1
CO2	3	3	1	2	1	1
CO3	3	1	1	1	1	2
CO4	2	1	1	1	1	1
CO5	3	1	1	1	1	1

1. Advanced Application    2. Intermediate Development    3. Introductory Level

COURSE DESIGNER: Dr. R. REKHA and Dr. R. SATHEESH MURUGAN



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

28

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBCP1	LAB IN FUNDAMENTALS OF MICROBIOLOGY	CORE PRACTICAL – I	–	3	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course has been designed to provide the fundamental knowledge on basic microbiology to understand the requirements of microbial growth and its control.

### COURSE OBJECTIVES:

- To comprehend the knowledge of practical applications in the field of basic microbiology.
- To acquire the expertise on isolation and characterization of microbes.
- To obtain the cognizance on principles of sterilization and its impact on microbial growth.

### COURSE OUTCOMES (COs)

After the completion of the course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	learn the aspects of sterilization techniques	Upto K3
CO 2	gain knowledge on microbiological media preparation and staining techniques.	Upto K3
CO 3	acquire awareness on microbial isolation and identification.	Upto K3
CO 4	realise the significance of biochemical characterization of microbes.	Upto K3
CO 5	comprehend the principles of various staining techniques.	Upto K3



# **SOURASHTRA COLLEGE, MADURAI – 625004**

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## **B.Sc. MICROBIOLOGY – SYLLABUS**

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

29

### **LAB IN FUNDAMENTALS OF MICROBIOLOGY**

#### **BASIC MICROBIOLOGY:**

1. Microbiology lab safety and precautions
2. Measurement of Cell size by Micrometry.
3. Sterilization techniques: Physical and Chemical methods.
4. Preparation of various microbiological media.
5. Pure culture techniques – Streak, Spread and Pour Plate methods.
6. Isolation and enumeration of bacteria from environmental samples.
7. Isolation and enumeration of fungi from environmental samples.
8. Observation of bacterial motility by Hanging drop Method.
9. Staining Techniques – Simple, Gram’s Staining, Capsule Staining, Fungal Staining and Endospore Staining.

#### **MICROBIAL TAXONOMY:**

##### **A. Observation of microbial structures and characteristic features –**

###### **Demonstration:**

**Bacteria** : *E. coli, Bacillus, Clostridium*

**Algae** : *Chlorella, Euglena, Chlamydomonas, Diatoms.*

**Fungi** : *Rhizopus, Mucor, Aspergillus, Penicillium* and Yeast.

**Viruses** : T<sub>4</sub>, Lambda, HIV and TMV.

##### **B. Biochemical tests for bacterial identification:**

6. Carbohydrate fermentation and acid – gas production.
7. IMVIC tests.
8. Catalase test.
9. Oxidase test.
10. TSI.
6. Starch, Lipid and protein hydrolysis

##### **C. Microbial Physiology:**

Measurement of microbial cell count

#### **TEXT BOOK:**

Mukherjee, K.L., *Medical Laboratory Technology* Vol –I, III, Tata McGraw – Hill publishing company Ltd., New Delhi.



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

30

### REFERENCE BOOKS:

1. P. Gunasekaran. 2<sup>nd</sup> edition, 2018, *Laboratory Manual in Microbiology* by. New Age International (P) Ltd.
2. Cappuccino.Welsh.2017, *Microbiology A Laboratory Manual*. 11<sup>th</sup>Edition. Pearson Education.
3. James G. Cappuccino, Natalie Sherman1999 *Microbiology: A Laboratory Manual*, Benjamin/Cummings
4. Senthil kumar.B,2014.*Practical Microbiology – A Laboratory Manual*. Panima Publishing Corporation, New Delhi, India.
5. Kannan. First Edition. 1996. *Laboratory Manual in General Microbiology*, Palani Paramount Publications.

### DIGITAL TOOLS:

1. <https://guides.baker.edu/c.php?g=303096&p=2028580>
2. <https://nios.ac.in/media/documents/dmlt/Microbiology/Lesson – 11.pdf>
3. <https://courseware.cutm.ac.in/wp – content/uploads/2020/05/Micrometer.pdf>
4. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4846335/>
5. <https://microbialnotes.com/motility – test – by – using – hanging – drop – method – explained>

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	2	3	3	3	3
CO2	3	1	3	3	3	3
CO3	3	3	2	3	3	3
CO4	2	3	2	1	2	2
CO5	2	3	3	3	3	3

3. Advanced Application      2. Intermediate Development      1. Introductory Level

**COURSE DESIGNER: Dr. K. RAGHAVAN and Dr. V. SELVI**



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

31

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBA21	ALLIED CHEMISTRY FOR LIFE SCIENCES	ALLIED – 2	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course will help the students develop comprehensive understanding of acids and base concepts, explore the classification, properties, and multifaceted applications of carbohydrates, gain foundational knowledge about vitamins, acquire understanding about alkaloids, terpenoids, and delve into pharmaceutical chemistry within this course.

### COURSE OBJECTIVES:

This course aims at giving an overall view to

- Gain a foundational understanding of acids and base.
- Familiarize with the classification, properties, and diverse applications of carbohydrates.
- Identify the biological functions of vitamins and comprehend their role in deficiencies.
- Understand the occurrence, extraction methods, classification, structures, and biological significance of alkaloids and terpenoids.
- Recognize the classification, properties, and impact of analgesics, antipyretics, anaesthetics, and antibiotics.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	grasp the fundamental concepts of acids and base in inorganic chemistry.	Upto K3
CO 2	comprehend the structural organization, chemical properties, and diverse applications of carbohydrates.	Upto K3
CO 3	identify the biological functions of vitamins and their implications in deficiency diseases.	Upto K3
CO 4	understand the occurrence, structural variations, and biological significance of alkaloids and terpenoids.	Upto K3
CO 5	appreciate the classification, structural aspects, and therapeutic applications of analgesic, antipyretic, anesthetic, and antibiotic drugs.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with 'B+' grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

32

### ALLIED CHEMISTRY FOR LIFE SCIENCES

#### UNIT – I: Concept of Acids And Bases:

[12Hrs]

Arrhenius concept, Bronsted – Lowry concept, conjugate acid – base pairs, Lewis concept– ionic product of water – pH and pOH – pH meter – buffer solutions and its types – Henderson equation – biological applications of buffer solutions – acid – base titrations – indicators – theory of indicators.

#### UNIT – II: Carbohydrates:

[12Hrs]

Definition – classification – monosaccharides: chemical properties of glucose and fructose – uses – disaccharides: sucrose – manufacture and properties – polysaccharides: study of starch and cellulose (structure) – applications – colour reactions.

#### UNIT – III: Vitamins:

[12Hrs]

Vitamins – Fat (A, D, E and K) and water – soluble vitamins (B complex and C) – sources, biological functions and deficiency diseases.

#### UNIT – IV: Alkaloids And Terpenoids:

[12Hrs]

a) **ALKALOIDS:** Definition – occurrence – extraction – general properties – classification – structure (no elucidation) and biological importance of cocaine, nicotine and piperine.

b) **TERPENOIDS:** Definition – occurrence – isolation – isoprene rule – classification – general properties – structure (no elucidation) and biological importance of citral, geraniol and menthol.

#### UNIT – V: Drugs:

[12Hrs]

a) **ANALGESICS AND ANTIPYRETICS:** Definition – types – narcotic analgesics: morphine, pethidine and methadone – non – narcotic analgesics: aspirin, methyl salicylate, paracetamol – structure and uses.

b) **ANAESTHETICS:** Definition – characteristics – classification – general anaesthetics: chloroform, nitrous oxide, cyclopropane – local anaesthetics: cocaine, procaine, amethocaine – structure and uses.

c) **ANTIBIOTICS:** Definition – condition – classification – structure and therapeutic uses of penicillin, streptomycin, chloramphenicol and tetracycline.





# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with 'B+' grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

33

### TEXT BOOKS:

1. *A Text Book of Organic Chemistry* by B.S. Bahl & Arun Bahl., S. Chand Publishing, (2019).
2. *Textbook of Organic Chemistry* by P.L. Soni & H.M. Chawla, S. Chand & Co. (2016).
3. *A Textbook of Pharmaceutical Chemistry* by Jayashree Ghosh, S. Chand & Co (2019).

### REFERENCE BOOKS:

1. *Advanced Organic Chemistry* by Arun Bahl and B.S. Bahl, S Chand Publishing, (2022).
2. *Organic Chemistry of Natural Products (vol – I)* by Gurdeep Chatwal., Himalaya publishing house (2019).
3. *Organic Chemistry of Natural Products (vol – II)* by Gurdeep Chatwal., Himalaya publishing house (2019).

### DIGITAL TOOLS:

1. <https://youtu.be/EvBkPwsRY2E?si=6K3sl – zOJmOXk9iE>
2. <https://youtu.be/F59RwK9hya8?si=nwzxBkzs0YM0GGDB>
3. [https://youtu.be/QbN8e7XMFSM?si=98pHiNdoJeC1\\_7Mj](https://youtu.be/QbN8e7XMFSM?si=98pHiNdoJeC1_7Mj)
4. <https://youtu.be/5kCJwE4DC0w?si=py1Vr5ipsnATY5rf>
5. <https://youtu.be/sGrwIVfshBg?si=0GiYaM9tvIGI1BDr>
6. <https://youtu.be/1TX0HKpq – E4?si=JgINBliMdFHXB86j>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	1	3	3	2
CO2	3	3	2	1	3	2
CO3	3	2	1	2	3	2
CO4	3	3	3	2	3	2
CO5	3	3	3	2	3	1

3. Advanced Application      2. Intermediate Development      1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

34

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBAP1	VOLUMETRIC ANALYSIS	ALLIED PRACTICAL – I	–	2	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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### COURSE DESCRIPTION:

This course gives the practical knowledge in volumetric analysis.

### COURSE OBJECTIVE:

A double titration involving the making up of the solution to be estimated and the preparation of primary standard solutions.

### COURSE OUTCOMES (CO):

No.	Course Outcome	Knowledge Level (According to Bloom’s Taxonomy)
CO	Illustrate the estimation of substance by various types of titration method	Upto K3

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard Solution



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

35

### VOLUMETRIC ANALYSIS

#### LIST OF EXPERIMENTS

##### 1. ACIDMETRY AND ALKALIMETRY

1. Titration between a strong acid and strong base
2. Titration between a strong acid and weak base
3. Titration between a weak acid and strong base

##### 2. PERMANGANOMETRY

1. Titration between potassium permanganate and oxalic acid
2. Titration between potassium permanganate and ferrous sulphate
3. Titration between potassium permanganate and Mohr’s salt

##### 3. EDTA TITRATIONS (DEMONSTRATION ONLY)

1. Estimation of  $\text{Ca}^{2+}$  ions in water using EDTA
2. Estimation of  $\text{Mg}^{2+}$  ions in water using EDTA

#### Summative Examination at the end of semester II

Max.marks – 100

Distribution of Marks: Internal – 40 Marks  
External – 60 Marks

Duration of Examination: 3 hrs

#### Internal

Class Experiments : 30 marks  
Observation note book : 10 marks  
Total : 40 marks

#### External examination

Record Notebook : 10 marks  
Procedure writing : 10 marks  
Experiment : 40 marks  
Total : 60 marks

For Estimation, if the student has

< 2% error – 40 marks  
2 – 3% error – 35 marks  
3 – 4% error – 30 marks  
4 – 5% error – 25 marks  
> 5% error – 15 marks

#### TEXT BOOK:

*Vogel’s Textbook of Quantitative Inorganic Analysis* 4<sup>th</sup> Edn. (1978).

#### REFERENCE BOOK:

*Basic Principles of Practical chemistry* by V. Venkatheswaran, R. Veeraswamy and A. R. Kulandaivelu, 2<sup>nd</sup> Edn. S. Chand and Co. Ltd. (2015).

#### DIGITAL SOURCES:

1. <https://www.youtube.com/watch?v=V9tAQI2XcHw>
2. <https://www.youtube.com/watch?v=cEOvj6jkdDw>

#### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO	3	3	3	3	3	3

3. Advanced Application    2. Intermediate Development    1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN



# SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

36

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
24UMBS21	DIAGNOSTIC MICROBIOLOGY AND HAEMATOLOGY	SBS – 2	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
I	II	25	75	100

NATURE OF COURSE	Employability <input type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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### COURSE DESCRIPTION:

This course is designed to provide an in depth understanding of disease process and diagnostic techniques which links the academic knowledge to the practical application of biomedical science, particularly in relation to modern diagnostic methods.

### COURSE OBJECTIVES:

- To help the students acquire knowledge on clinical specimen analysis in laboratory
- To make the students obtain familiarity on the concepts of haematology
- To train the students in the fields of Basic Clinical and medical microbiology.

### COURSE OUTCOMES (COs):

After the completion of the course, the students will be able to

No.	Course Outcomes	Knowledge Level (According to Bloom’s Taxonomy)
CO 1	acquire the knowledge on the laboratory identification of infectious agents and staining techniques.	Upto K3
CO 2	gain the knowledge on microbial analysis of clinical samples.	Upto K3
CO 3	understand the principles of haematology.	Upto K3
CO 4	acquire the knowledge on routine haematological assays.	Upto K3
CO 5	obtain awareness on concepts of clinical pathology.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## **B.Sc. MICROBIOLOGY – SYLLABUS**

**(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)**

37

### **DIAGNOSTIC MICROBIOLOGY AND HEAMATOLOY**

#### **UNIT – I:**

Laboratory safety management and regulations; clinical sample Collection, handling and transport. Laboratory identification of infectious agents. Staining Techniques – Simple, Gram’s, Acid – Fast and Spore Staining.

#### **UNIT – II:**

Microbial analysis of clinical samples – Urine, Stool, Blood, Pus and Throat Swab. Minimal Inhibitory Concentration (MIC) of antibiotics. Antimicrobial Susceptibility tests.

#### **UNIT – III:**

Blood – Components and their functions; Blood cells – RBC, WBC – Types, Lymphocytes and Thrombocytes; Blood collections methods – vein puncture and capillary puncture; anti – coagulants; diluting fluids; Separation of Serum and Plasma; bleeding time, clotting time.

#### **UNIT – IV:**

Routine Haematological tests – Determination of Haemoglobin content, Counting of Blood Cells – Total RBC count, Total WBC count, Differential Leucocyte count, Platelet count and Reticulocyte; Erythrocyte Sedimentation Rate.

#### **UNIT – V:**

Clinical pathology – analysis and examination of urine, stool, sputum, CSF and semen. Routine procedure in Blood Bank: ABO Blood grouping and Rh typing. Cross matching.

#### **TEXT BOOKS:**

1. Mukherjee, K.L., 2005, Vol –I, III, *Medical Laboratory Technology* Tata McGraw – Hill publishing company Ltd, New Delhi.
2. Ananthanarayanan R and Jayaram Panicker, C. K., 2005, *Text book of Microbiology*, Orient Longman.
3. Mahon.C.R, Lehman.D.C., 2023. 7th edition, *Textbook of diagnostic microbiology*, Elsevier – Health sciences division.
4. Saxena., 2008,1st Edition, *Laboratory Techniques in haematology*, Jaypee brothers medical publishers.
5. John V. Dacie , S.M. Lewis., 2005, 12<sup>th</sup> edition. *Practical Haematology* ELBS. Churchill Livingstone

#### **REFERENCE BOOKS:**

1. Barbara,J. Bain, Imelda Bates., Michael.A.Laffan, Dacie and Lewis, 12<sup>th</sup> Edition, 2017, *Practical haematology*, Elsevier.
2. Patrica.M.Tille., 15<sup>th</sup> Edition, 2021. Bailey & Scotts, *Diagnostic Microbiology*, Elsevier.
3. Connie R. Mahon, David Fowler, 2003, *Diagnostic Skills in Clinical Laboratory Science*, McGraw Hill Professional.
4. Bailey & Scott’s, 15<sup>th</sup> Edition, 2021, *Diagnostic Microbiology*, Elsevier Health Sciences.
5. James Cappuccino, Chad Welsh, 11<sup>th</sup> Edition, 2023, *Microbiology: A Laboratory Manual*, Pearson Education, Elsevier.



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(An Autonomous Institution Re – accredited with ‘B+’ grade by NAAC)

## B.Sc. MICROBIOLOGY – SYLLABUS

(Under CBCS based on OBE) (For those admitted during 2024 – 2025 and after)

38

### DIGITAL TOOLS:

1. <https://www.elsevier.es/en> – revista – enfermedades – infecciosas – microbiologia – clinica – english – 428 – articulo – collection – transport – general – processing – clinical – S2529993X18302624
2. <https://medlineplus.gov/lab> – tests/antibiotic – sensitivity – test/
3. <https://www.healthline.com/health/wbc> – count
4. <https://pathlabs.ufl.edu/client> – services/specimen – shipping/blood – collection – procedure – capillary/
5. <https://vishwarajhospital.com/what> – does – a – clinical – pathologist – do/

### Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1	3	3	3	3	3	3
CO2	1	1	3	3	3	3
CO3	3	3	1	2	1	3
CO4	1	2	3	3	3	3
CO5	3	3	3	3	3	3

3. Advanced Application      2. Intermediate Development 1. Introductory Level

**COURSE DESIGNER: Dr. K. RAGHAVAN and Dr. S. ANJANA PRIYA**