

**CAUVERYCOLLEGEFORWOMEN(AUTONOMOUS)**

**Nationally Accredited with 'A' Grade by NAAC**

**ISO 9001:2015Certified**

**TIRUCHIRAPPALLI**

**PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY**



**B.Sc.,MICROBIOLOGY**

**SYLLABUS**

**2022 -2023 and Onwards**



**CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)  
PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY**

**VISION**

Our vision is to encourage eminent research work through the conception of an attractive and vibrant environment to achieve goals of our department.

**MISSION**

- To impart relevant, ultimate, principle-oriented education and practical expertise in the field of Microbiology.
- To strive to provide quality education conjugated with innovative technology so as to be able to gain technical and educational expertise locally, nationally, internationally.
- Our prime focus is to enrich the ambitions of our students, staff and steer with constructive collaboration towards excellence.

## PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

<b>PEOs</b>	<b>Statements</b>
<b>PEO1</b>	<b>LEARNING ENVIRONMENT</b> To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
<b>PEO2</b>	<b>ACADEMIC EXCELLENCE</b> To provide a conducive environment to unleash their hidden talents and to nurture the spirit of critical thinking and encourage them to achieve their goal.
<b>PEO3</b>	<b>EMPLOYABILITY</b> To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
<b>PEO4</b>	<b>PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY</b> To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
<b>PEO5</b>	<b>GREEN SUSTAINABILITY</b> To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

**PROGRAMME OUTCOMES FOR B.Sc., MICROBIOLOGY PROGRAMME**

<b>PONO.</b>	<b>On completion of B.Sc., Microbiology, the students will be able to</b>
<b>PO1</b>	<b>Academic Excellence and Competence:</b> Elicit firm fundamental knowledge in theory as well as practical for coherent understanding of academic field to pursue multi and interdisciplinary science careers in future.
<b>PO2</b>	<b>Holistic and Social approach:</b> Create novel ideas related to the scientific research concepts through advanced technology and sensitivity towards sustainable Environmental practices as well as social issues.
<b>PO3</b>	<b>Professional ethics and Team Work:</b> Explore professional responsibility through projects, internships, field trip/industrial visits and mentorship Programmes to transmit communication skills.
<b>PO4</b>	<b>Critical and Scientific thinking:</b> Equip training skills in Internships, Research Project to do higher studies in multidisciplinary path with higher level of specialization to become professionals of high-quality standards.
<b>PO5</b>	<b>Social Responsibility with ethical values:</b> Ensure ethical, social and holistic values in the minds of learners and attain ender parity for building a healthy nation.

**PROGRAMME SPECIFIC OUTCOMES FOR B.Sc., MICROBIOLOGY**

<b>PSO NO.</b>	<b>Students of B.Sc., Microbiology will be able to</b>	<b>Pos Addressed</b>
<b>PSO1</b>	Improve their knowledge on the basic concepts for retaining competence and confidence which enables them to develop interest in the new arena of Microbiology	<b>PO1, PO5</b>
<b>PSO2</b>	Acquire expertise in practical work within dependent equipment Handling skill along with collection and interpretation of scientific data	<b>PO2, PO3</b>
<b>PSO3</b>	Legitimise knowledge by emerging multiple aspects of current research.	<b>PO3, PO5</b>
<b>PSO4</b>	Pursue the importance of substantial original Research to meet the current and future expectation.	<b>PO4, PO1</b>
<b>PSO5</b>	Be aware of the ethical issues for the benefit of the society by adding skilled scientific work for across the country.	<b>PO5, PO2</b>



**Cauvery College for Women (Autonomous)**  
PG & Research Department of Microbiology

B.Sc., Microbiology

Learning Outcome Based Curriculum Framework (CBCS-LOCF)  
(For the Candidates admitted from the Academic year 2022-2023 and onwards)

Semester	Part	Course	Title	Course Code	Inst. Hrs.	Credits	Exam			Total
							Hrs.	Marks		
								Int	Ext	
I	I	Language Course-I (LC) Tamil / other languages	இக்கால இலக்கியம்	22ULT1	6	3	3	25	75	100
			Hindi Literature & Grammar-I	22ULH1						
			Basic French-I	22ULF1						
			History of Popular Tales Literature and Sanskrit Story	22ULS1						
	II	English Language Course- I(ELC)	Functional English for Effective Communication-I	22UE1	6	3	3	25	75	100
	III	Core Course – I(CC)	General Microbiology	22UMB1CC1	5	5	3	25	75	100
				22UMB1CC1P	3	3	3	40	60	100
				22UMB1AC1	5	3	3	25	75	100
				22UMB1AC2P	3	3	3	40	60	100
	IV	Ability Enhancement Compulsory Course-I (AECC)	UGC Jeevan Kaushal-Universal Human Values	22UGVE	2	2	-	100	-	100
<b>TOTAL</b>					<b>30</b>	<b>22</b>				<b>700</b>
II	I	Language Course-II(LC)Tamil / Other languages	இடைக்கால இலக்கியமும் புதினமும்	22ULT2	5	3	3	25	75	100
			Hindi Literature & Grammar-II	22ULH2						
			Basic French-II	22ULF2						
			Poetry, Textual Grammar and Alankara	22ULS2						
	II	English Language Course- II(ELC)	Functional English for Effective Communication-II	22UE2	6	3	3	25	75	100
	III	Core Course – II (CC)	Microbial Physiology	22UMB2CC2	5	5	3	25	75	100
				22UMB2CC2P	3	3	3	40	60	100
				22UMB2CC3	3	3	3	25	75	100
				22UMB2AC3	4	3	3	25	75	100
	IV	Ability Enhancement Compulsory Course-II (AECC)	Environmental Studies	22UGEVS	2	2	-	100	-	100

IV	Ability Enhancement Compulsory Course-III (AECC)	Innovation and Entrepreneurship	22UGIE	2	1	-	100	-	100
Extra Credit Course		SWAYAM	As Per UGC Recommendation						
<b>TOTAL</b>				<b>30</b>	<b>23</b>				<b>800</b>

III	I	Language Course-III(LC) Tamil*/Other Languages*	காப்பியமும் நாடகமும்	22ULT3						
			Hindi Literature & Grammar-III	22ULH3	5	3	3	25	75	100
			Intermediate French-I	22ULF3						
			Prose, Textual Grammar and Vakyarachana	22ULS3						
	II	English Language Course-II(ELC)	Learning Grammar Through Literature-I	22UE3	6	3	3	25	75	100
	III	Core Course-IV(CC)	Virology	22UMB3CC4	6	6	3	25	75	100
		Core Practical - III(CP)	Virology (P)	22UMB3CC3P	3	3	3	40	60	100
		Second Allied Course-I (AC)	Biostatistics	22UMB3AC4	4	3	3	25	75	100
		Second Allied Course-II (AP)	Biostatistics (P)	22UMB3AC5P	4	3	3	40	60	100
	IV	Generic Elective Course- I (GEC)	A. Mushroom Technology	22UMB3GEC1	2	2	3	25	75	100
B. Basic Tamil-I			22ULC3BT1							
C. Special Tamil-I			22ULC3ST1							
Extra Credit Course		SWAYAM	As Per UGC Recommendation							
<b>TOTAL</b>				<b>30</b>	<b>23</b>				<b>700</b>	

### 15 Days INTERNSHIP during Semester Holidays

IV	I	Language Course-IV (LC) Tamil*/Other Languages*	பண்டைய இலக்கியமும் உரைநடையும்	22ULT4	6	3	3	25	75	100
			Hindi Literature & Functional Hindi	22ULH4						
			Intermediate French-II	22ULF4						
			Drama, History of Drama Literature	22ULS4						
	II	English Language Course -IV(ELC)	Learning Grammar Through Literature-II	22UE4	6	3	3	25	75	100
	III	Core Course - V(CC)	Immunology	22UMB4CC5	6	6	3	25	75	100
		Core Practical -IV(CP)	Immunology (P)	22UMB4CC4P	4	4	3	40	60	100
		Second Allied Course-III (AC)	Bioinformatics	22UMB4AC6	4	3	3	25	75	100
		Internship	Internship	22UMB4INT	-	2	-	-	-	100
	IV	Generic Elective	A. Biofertilizer Technology	22UMB4GEC2	2	2	3	25	75	100
B. Basic Tamil-II			22ULC4BT2							

	Course- II (GEC)	C. Special Tamil-II	22ULC4ST2							
	Skill Enhancement Course-I(SEC)	Herbal Medicine (P)	22UMB4SEC1P	2	2	3	40	60	100	
	Extra Credit Course	SWAYAM	As Per UGC Recommendation							
	<b>TOTAL</b>			<b>30</b>	<b>25</b>					<b>800</b>

V	III	Core Course –VI(CC)	Medical Microbiology	22UMB5CC6	6	6	3	25	75	100
		Core Course -VII(CC)	Agricultural and Environmental Microbiology	22UMB5CC7	6	6	3	25	75	100
		Core Course – VIII(CC)	Molecular Biology	22UMB5CC8	6	6	3	25	75	100
		Core Practical – V(CP)	Medical Microbiology, Agricultural and Environmental Microbiology and Molecular Biology (P)	22UMB5CC5P	3	3	3	40	60	100
		Discipline Specific Elective – I (DSE)	A. Organic Farming	22UMB5DSE1A	5	4	3	25	75	100
	B. Medical Parasitology		22UMB5DSE1B							
	C. Fundamentals of Botany and Zoology		22UMB5DSE1C							
	IV	Ability Enhancement Compulsory Course-IV(AECC)	UGC Jeevan Kaushal - Professional Skills	22UGPS	2	2	-	100	-	100
		Skill Enhancement Course –II(SEC)	Biofertilizer Technology (P)	22UMB5SEC2P	2	2	3	40	60	100
		Extra Credit Course	SWAYAM	As Per UGC Recommendation						
	<b>TOTAL</b>			<b>30</b>	<b>29</b>					<b>700</b>
VI	III	Core Course – IX(CC)	Fermentation Technology	22UMB6CC9	6	6	3	25	75	100
		Core Course –X(CC)	Food and Dairy Microbiology	22UMB6CC10	5	5	3	25	75	100
		Core Course –XI (CC)	Cyber security	22UGCS	5	4	3	25	75	100
		Core Practical – VI(CP)	Fermentation Technology and Food and Dairy Microbiology (P)	22UMB6CC6P	3	3	3	40	60	100
		Discipline Specific Elective – II (DSE)	A. Microbial Genetics	22UMB6DSE2A	5	4	3	25	75	100
			B. Microbial Biotechnology	22UMB6DSE2B						
	C. Biological Techniques		22UMB6DSE2C							
	Project	Project Work	22UMB6PW	5	4	-	-	100	100	
	V	Gender Studies	Gender Studies	22UGGS	1	1	-	-	-	100
Extension activity			22UGEA	0	1	0	-	-	-	
	<b>TOTAL</b>			<b>30</b>	<b>28</b>					<b>700</b>
	<b>GRANDTOTAL</b>			<b>180</b>	<b>150</b>					<b>4400</b>

## Courses & Credits for UG Science Programmes

Part	Course	No. of Courses	Credits	Total Credits
I	Tamil/ Other Language	4	12	12
II	English	4	12	12
III	Core (Theory& Practical)	17	77	109
	Project Work	1	4	
	Internship	1	2	
	First Allied	3	9	
	Second Allied	3	9	
	DSE	2	8	
IV	GEC	2	4	15
	SEC	2	4	
	AECC-I -Universal Human Values	1	2	
	AECC-II-Environmental Studies	1	2	
	AECC-III-Innovation and Entrepreneurship	1	1	
	AECC-IV Professional Skills	1	2	
V	Gender Studies	1	1	02
	Extension Activities	–	1	
		<b>44</b>		<b>150</b>

Internal and external marks for theory and practical papers are as follows:

Subject	Internal Marks	External Marks
Theory	25	75
Practical	40	60

**For Theory:**

- a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
- b) The passing minimum for End Semester Examinations shall be 40% out of 75 marks (i.e. 30 marks)

**For Practical:**

- a) The passing minimum for CIA shall be 40% out of 40 marks (i.e. 16 marks)
- b) The passing minimum for End Semester Examinations shall be 40% out of 60 marks (i.e., 24 marks)

### Internal Component (Theory)

Component	Marks
Quiz	10
Assignment & Seminar	10
CIA -I	05
Total	25

### Internal Component (Practical)

Component	Marks
Record Note	10
Continuous Performance in Practical (Attendance and Observation)	15
CIA	15
Total	40

**Question Paper Pattern for different courses +**





**CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS) TRICHY**  
**PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY**  
**B.SC., MICROBIOLOGY**  
**Learning Outcome Based Curriculum Framework (CBCS-LOCF)**  
**(For the candidates admitted from the Academic year 2022-2023 and onwards)**

Semester	Part	Course	Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
							Hrs.	Marks		
								Int	Ext	
I	I	Language Course I (LC) Tamil*/Other Languages*	இக்கால இலக்கியம்	22ULT1	6	3	3	25	75	100
			Hindi Literature & Grammar-I	22ULH1						
			Basic French-I	22ULF1						
			History of Popular Tales, Literature and Sanskrit Story	22ULS1						
	II	English Language Course- I(ELC)	Functional English for Effective Communication-I	22UE1	6	3	3	25	75	100
	III	Core Course – I(CC)	General Microbiology	22UMB1CC1	5	5	3	25	75	100
				Core Practical - I (CP)	General Microbiology (P)	22UMB1CC1P	3	3	3	40
		First Allied Course-I (AC)	Fundamentals of Biochemistry	22UMB1AC1	4	3	3	25	75	100
		First Allied Course-II (AC)	Fundamentals of Biochemistry (P)	22UMB1AC2P	4	3	3	40	60	100
	IV	Ability Enhancement Compulsory Course-I (AECC)	UGC Jeevan Kaushal- Universal Human Values	22UGVE	2	2	-	100	-	100
<b>Total</b>					<b>30</b>	<b>22</b>				<b>700</b>

<b>Semester: I</b>	<b>Internal Marks : 25</b>		<b>External Marks : 75</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>Hrs./Week</b>	<b>CREDITS</b>
22UMB1CC1	GENERAL MICROBIOLOGY	CORE	5	5

### Course Objective

- This subject aims to introduce the history and development of Microbiology. The contents of this course will help students understand history, biology of microorganisms, growth and control of microbes.
- Thus, the beginners are rightly exposed to foundation of Microbiology which would lead them towards progressive advancement of the subject.

### Course Outcome and Cognitive level Mapping

CO Number	CO Statement	Cognitive level
CO 1	Remember and understand the Development of Microbiology	K1, K2
CO 2	Analyze the Size and Shape of Microorganisms using Microscope	K3
CO 3	Evaluate the knowledge about Bacteria and Viruses	K4
CO 4	Compare the various Preservation Methods for preserving Microbes.	K5
CO 5	Create the various applications of Extremophiles	K6

### Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	2	3	3	3	3	2	3
CO2	3	2	3	3	2	2	3	2	3	3
CO3	3	2	2	3	3	3	2	3	3	2
CO4	2	3	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	3	3	2	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial ( High) Correlation

“-“ indicates there is no correlation

### Syllabus

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	<b>History and Scope of Microbiology:</b> Introduction- Definition, scope and Spontaneous generation vs. biogenesis. History of Microbiology- Domain and kingdom concepts, Contributions of Anton von Leeuwenhoek, Louis Pasteur, Robert Koch, Joseph Lister, Alexander Flemming Role of microorganisms in fermentation, Germ	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.

	theory of disease, Development of various microbiological techniques and golden era of microbiology. Microscopy: Principles and applications of bright field, dark field, phase contrast, fluorescent SEM and TEM.			
II	<b>Structure of Bacteria</b> : Difference between prokaryotic and eukaryotic microorganisms. Brief outline of Bergey's manual of systemic bacteriology. Structural organization of bacteria – Size, shape and arrangement of bacterial cells - Ultrastructure of a bacterial cell - cell wall, cell membrane, ribosomes, nucleoid, slime, capsule, flagella, fimbriae, spores, cysts, plasmid, mesosomes and cytoplasmic inclusions	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
III	<b>Cellular and Acellular organisms:</b> General characteristics and nature of Cellular and Acellular organisms- Archaeobacteria, Mycoplasma, Rickettsiae, Chlamydia, Spirochaetes, Actinobacteria, Protozoa, Algae, Fungi, lichens, Viruses, viroids and prions.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
IV	<b>Pure culture techniques:</b> Sterilization: Principles and methods – physical methods- moist heat, dry heat, filtration and media preparation. Cultivation of microbes- Types of culture media- Stab, slant, broth, semisolid, solid media. Aerobic and Anaerobic culture techniques- Pure culture techniques – Maintenance and preservation of microbes. Principles and types of staining– Simple, differential, Capsule staining.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
V	<b>Extremophiles:</b> Introduction to Extremophiles– Thermophiles, Psychrophiles, barophiles, Halophiles, Alkanophiles, Acidophiles, Methanogenesis and their applications.	15	CO1, CO2, CO3, CO4, CO5.	K1, K2, K3, K4, K5.
VI	<b>Self Study for Enrichment (Not to be included for External Examination)</b> Microscopic operations, Criteria for Classification of Microorganisms, cellular organizations, Isolation and identification of Microorganisms, Cultivation methods for Extremophiles.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

### **Text Books**

1. Dubey RC and Maheswari DK. (2015). *A Text Book of Microbiology*. 5th Edition. S Chand, New Delhi.
2. Ananthanarayan Paniker (2020). *A Text book of Microbiology*. 11th Edition. University Press. Singapore.
3. Madigan MT, Martinko JM, and Parker J. (2019). *Biology of Microorganisms*. 12th Edition, MacMillan Press. England.
4. Pelczar MJ, Chan ECS and Kreig NR. (2015). *Microbiology*, 5th edition. McGraw-Hill. Book Co. Singapore.
5. Atlas RA and Bartha R. (2019). *Microbial Ecology. Fundamentals and Application*. 4th edition Benjamin Cummings, New York.

### **Reference Books**

1. Prescott L.M, Harley, J.P. and Helin, D.A. (2017). *Microbiology*, 5th Edition. McGraw Hill.
2. Tortora GJ, Funke BR and Case CL. (2020). *Microbiology: An Introduction*. 9th Edition, Pearson Education, Singapore.
3. Black JG. (2018). *Microbiology-principles and explorations*, 6th edition. John Wiley and Sons, Inc. New York.
4. Moselio Schaechter and Joshua Leaderberg (2019). *The Desk encyclopedia of Microbiology*. 2nd edition. Elsevier Academic press, California.
5. Madigan MT, Martinko JM, and Parker J. (2019). *Biology of Microorganisms*, 12th Edition. MacMillan Press, England.

### **Web Reference**

1. <https://microbenotes.com/history-of-microbiology/>
2. <https://byjus.com/biology/prokaryotic-and-eukaryotic-cells/>
3. <https://byjus.com/biology/archaeobacteria/>
4. <https://thebiologynotes.com/sterilization-physical-and-chemical-methods/>
5. <https://microbenotes.com/microbiology-of-extreme-environments/>

### **Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar.

### **Course Designer**

Dr. V. Aruna

<b>Semester : I</b>	<b>InternalMarks:40</b>		<b>ExternalMarks:60</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB1CC1P</b>	<b>GENERAL MICROBIOLOGY (P)</b>	<b>CORE PRACTICAL</b>	<b>3</b>	<b>3</b>

### Course Objective

- To enable the students to understand the basic knowledge of aseptic techniques preparation and sterilization of media, pure culture techniques
- To acquire adequate skill to handle microscope to visualize microbes.

### Course Outcomes and Cognitive Level Mapping

On the successful completion of the course, students will be able to

<b>CONumber</b>	<b>CO Statement</b>	<b>Cognitivelevel</b>
CO1	Recall the safety practice in microbiological laboratory	K1
CO2	Demonstrate the accuracy of sterilization	K2
CO3	Develop skills to observe microbes using microscopes	K3
CO4	Competently prepare and cultivate bacteria, fungi and cyanobacteria using media	K3
CO5	Explain various pure culture techniques	K4

### Mapping of CO with PO and PSO

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
CO1	3	2	2	3	3	3	2	2	2	3
CO2	3	2	3	3	2	3	2	2	3	3
CO3	3	3	3	2	3	3	3	3	3	2
CO4	3	3	2	3	2	3	2	2	3	2
CO5	3	3	3	2	3	3	3	3	3	2

“1” – Slight (Low) Correlation

“3” – Substantial ( High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

## Syllabus

1. Safety & Good laboratory practices
2. Basic concepts of Microscope and its operation
3. Principles and operations—Autoclave, Hot Air Oven, Incubators, Laminar Air Flow chamber, Filtration, colony counter, Centrifuge, pH meter, Colorimeter and Spectrophotometer
4. Cleaning and sterilization of glassware.
5. Preparation of culture media—solid, semi-solid and liquid.
6. Isolation of bacteria, fungi and cyanobacteria from soil and water
7. Enumeration of bacterial numbers by viable count (Plate count)
8. Pure culture techniques - Streak plate, Pour plate and Spread plate.
9. Test for motility of bacteria – Hanging Drop Method
10. Staining techniques – Simple staining, Gram's staining, Spore-staining, Capsular staining, LCB mount and Saline mount
11. Observation of permanent slides to study the structural characteristics of algae (*Anabaena*, *Nostoc*, *Spirulina*, *Oscillatoria*), fungi (*Pythium*, *Rhizopus*, *Saccharomyces*, *Penicillium*, *Aspergillus*, *Agaricus*) and protozoa (*Entamoeba histolytica* and *Plasmodium spp.*).

## Reference Books

1. Bharti Arora, D.R. Arora (2020), *Practical Microbiology*, CBS Publishers & Distributors
2. Mudili J (2020), *Introductory Practical Microbiology*, Narosa Das S (2020), *Microbiology Practical Manual*, CBS Publishers
3. Saravanan R, D. Dhachinamoorthi, CH. MM. Prasada Rao, (2019), *A Hand book of Practical Microbiology*, LAP LAMBERT Academic Publishing.
4. Shukla Das and Rumpa Saha (2019). *Microbiology Practica lManual*, 1<sup>st</sup> Edition CBS Publishers and Distributors.
5. Amita Jain, Jyotsna Agarwal, Vimala Venkatesh (2018), *Microbiology Practical Manual*, 1<sup>st</sup> Edition, Elsevier India.
6. Cappuccino and Sherman (2016), *Microbiology–A Laboratory Manual*, 11<sup>th</sup> Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
7. R.C. Dubey, Dr. D.K. Maheswari (2010), *Practical Microbiology*, Kindle Edition

## Web References

1. <https://unitedvrg.com/2019/03/28/microbiology-a-laboratory-manual-11th-edition-2016-pdf/>
2. <https://www.youtube.com/watch?v=hxausVA8a3E>
3. <https://www.youtube.com/watch?v=sxa46xKfIOY>
4. <https://www.youtube.com/watch?v=lu9CvIF20pc>
5. <https://study.com/learn/lesson/simple-differential-staining-techniques.html>
6. <https://www.youtube.com/watch?v=xjYdOcT6s1Y>
7. <https://bitesizebio.com/853/5-laboratory-sterilisation-methods/>
8. <https://www.youtube.com/watch?v=QqWcUzpzZgw>

## Pedagogy

Power point presentations, Group Discussion, Quiz, Brain Storming Activity.

## Course Designer

Dr. P. Bhuvaneshwari

<b>Semester : I</b>	<b>InternalMarks:25</b>		<b>ExternalMarks:75</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB1AC1</b>	<b>FUNDAMENTALS OF BIOCHEMISTRY</b>	<b>ALLIED</b>	<b>4</b>	<b>3</b>

### Course Objective

- To understand the structure, functions of various biomolecules and consequences of deviation from normal

### Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Cognitive level</b>
CO1	Remember and understand the concept of macromolecules	K1,K2
CO2	Illustrate an idea about structure and function macromolecules	K2,K3
CO3	Categorize the sources of macromolecules	K4
CO4	Classify and relate properties o macromolecules	K3,K4
CO5	Recommend the daily allowances of vitamins and its significance	K5

### Mapping of CO with PO and PSO

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	2	2	3	3	3	2	2	3	2	3
<b>CO2</b>	3	3	2	3	3	2	2	3	3	3
<b>CO3</b>	2	3	3	2	3	3	3	2	3	3
<b>CO4</b>	2	3	3	3	2	3	2	3	3	3
<b>CO5</b>	3	3	2	3	3	3	3	2	3	3

“1”–Slight (Low) Correlation

“2” – Moderate (Medium)

Correlation“3”–Substantial (High) Correlation “-“indicates there is no correlation

### Syllabus

<b>UNIT</b>	<b>CONTENT</b>	<b>HOURS</b>	<b>COS</b>	<b>COGNITIV ELEVEL</b>
I	<b>Carbohydrates:</b> Definition, sources, classification-monosaccharide, disaccharide, oligosaccharide and Polysaccharide, biological significance, digestion and absorption of carbohydrates	12	CO1, CO2,CO3, CO4	K1,K2,K3,K4



II	<b>Proteins:</b> Definition, sources, classification and structure of proteins-structural and non-structural proteins, Amino acids–structure-classification-essential and non essential, protein and non-protein amino acids. Biological Significance of Proteins.	12	CO1, CO2,CO3, CO4	K1,K2,K3,K4
III	<b>Lipids:</b> Definition, Properties, Sources, Classification of lipids and fatty acids- saturated, unsaturated and polyunsaturated. Compound lipids - Structure and functions of phospholipids and glycolipids. Biological significance of lipids.	12	CO1, CO2,CO3, CO4	K1,K2,K3,K4
IV	<b>Nucleicacids:</b> Definition, structure–Nucleoside, Nucleotides, forms and functions of DNA. Types, structure and functions of RNA. Difference between DNA & RNA (mRNA, tRNA, rRNA).	12	CO1, CO2,CO3, CO4	K1,K2,K3,K4
V	<b>Vitamins:</b> Definition, sources, deficiency disorders and functions of Fat soluble vitamins (A, D, E and K) and Water soluble vitamins (B complex and C).	12	CO1, CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5
VI	<b>Self Study for Enrichment (Not to be included for External Examination)</b>  Diabetesmellitus–BloodPlasmaprotein–Lipoprotein–Phosphodiesterbond–structureofvitamins.	-	CO1, CO2,CO3, CO4,CO5	K1,K2,K3,K4, K5

## **Text Books**

1. AmbikaShanmugam(2016).*Fundamentals of Biochemistry for Medical Students*. 8<sup>th</sup> Edition, Wolters Kluwer (India) Pvt Ltd.
2. Rafi MD, (2014) *Textbook of Biochemistry for medical students*, 2<sup>nd</sup> edition, Universities Press, (India) Pvt. Ltd, Hyderabad, India.
3. Charlotte W Pratt and Sathyanarayana U and Chakrapani U (2013) *Biochemistry*, 4<sup>th</sup> edition, Elsevier publishers.
4. Deb AC (2011). *Fundamentals of Biochemistry*, 10<sup>th</sup> edition, New Central Book Agency (p) Ltd, London
5. Rajagopal G (2010). *Concise textbook of biochemistry*, 2<sup>nd</sup> edition, Ahuja Publishing House.

## **Reference Books**

1. Lubert Stryer; Jeremy Berg; John Tymoczko; Gregory Gatto (2019). *Biochemistry*, 9<sup>th</sup> Edition. Macmillan Publication.
2. Denise R Ferrier, (2013) *Biochemistry*, 6<sup>th</sup> edition, LWW publishers.
  3. Reginald H Garrett and Charles M Grisham (2012). *Biochemistry*, 5<sup>th</sup> edition. Brooks Cole publishers.
4. Albert L Lehninger, David L Nelson and Michael M Cox, (2010). *Lehninger Principles of Biochemistry*, 2<sup>nd</sup> edition, Wiley publisher

## **Web References**

1. <https://www.slideshare.net/namarta28/monosaccharides>
2. <https://www.tuscany-diet.net/proteins/classification/#:~:text=egg%20yolk%20phosvitin.>
3. <http://www.Protein%20classification%20based%20on%20shape,two%20classes%3A%20Of%20fibrous%20and%20globular.>
4. <https://byjus.com/biology/lipids/#:~:text=There%20are%20two%20major%20types,than%20alcohol%20and%20fatty%20acids.>
5. <https://www.thoughtco.com/dna-versus-rna-608191>

## **Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

## **Course Designer**

Dr.B.Thamilmaraiselvi

<b>Semester:I</b>	<b>InternalMarks:40</b>		<b>ExternalMarks:60</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB1AC2P</b>	<b>FUNDAMENTALS OF BIOCHEMISTRY (P)</b>	<b>ALLIED PRACTICAL</b>	<b>4</b>	<b>3</b>

### Course Objective

- This course enables the students to explore the basic biochemistry practical skills.

### Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Cognitive level</b>
CO1	Identify the carbohydrates, amino acids, proteins present in the given sample	K1
CO2	Interpret the amount of glucose present in the given sample by Anthrone method.	K2
CO3	Calculate the amount of amino acid present in the given sample by Ninhydrin method	K2
CO4	Analyse the amount of protein and cholesterol present in the given sample	K4
CO5	Evaluate the amount of DNA present in the given sample by Diphenylamine (DPA) method	K3

### Mapping of CO with PO and PSO

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	3	3	2	3	3	3	3	3	3	3
<b>CO2</b>	3	3	3	3	2	1	3	3	3	3
<b>CO3</b>	3	3	1	3	3	3	2	2	2	3
<b>CO4</b>	3	3	2	3	3	3	3	1	3	2
<b>CO5</b>	3	3	3	2	2	3	3	2	2	3

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

## **Syllabus**

1. Qualitative analysis of carbohydrates, amino acids and proteins.
2. Quantitative estimation of Glucose by Anthrone Method
3. Quantitative estimation of Amino acids by Ninhydrin Method
4. Quantitative estimation of Protein by Lowry's Method
5. Quantitative estimation of Cholesterol by Jacks Method
6. Quantitative estimation of DNA by Diphenylamine (DPA)Method

## **Reference Books**

1. Vasudevan and Sabir Kumar Doss(2022).*Practical Text book of Biochemistry for Medical students*
2. Damodaran Geetha K.(2016), *Practical Biochemistry*, JB brother medical publisher.
3. Ranjna Chawla.(2014). *Practical clinical Biochemistry*, JB brother medical publisher.
4. ManipalmanualofclinicalBiochemistry.2013,JB brother medical publisher.
5. Shawn O' Farrell and Ryan T Ranallo (2000). *Experiments in Biochemistry: A Hands onApproach-A manual for the undergraduate laboratory*, Thomson Learning, Inc., Australia.

## **Web References**

1. <https://www.youtube.com/watch?v=wmhmAESv72E>
2. <https://www.youtube.com/watch?v=VzYDk4t97Ok>
3. <https://www.youtube.com/watch?v=JdXbTWfOc18>
4. [https://www.youtube.com/watch?v=2LiA\\_yNMIVs](https://www.youtube.com/watch?v=2LiA_yNMIVs)

## **Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

## **Course Designer**

Dr. B. Thamilmaraiselvi



**CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS) TRICHY**  
**PG AND RESEARCH DEPARTMENT OF MICROBIOLOGY**  
**B.SC., MICROBIOLOGY**

**Learning Outcome Based Curriculum Framework (CBCS-LOCF)**  
**(For the candidates admitted from the Academic year 2022-2023 and onwards)**

Semester	Part	Course	Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
							Hrs.	Marks		
								Int.	Ext.	
II	I	Language Course II (LC) Tamil*/Other Languages*	இடைக்கால இலக்கியமும் புதினமும்	22ULT2	5	3	3	25	75	100
			Hindi Literature & Grammar-II	22ULH2						
			Poetry, Grammar and Alankara	22ULS2						
			Basic French-II	22ULF2						
	II	English Language Course- II(ELC)	Functional English for Effective Communication-II	22UE2	6	3	3	25	75	100
	III	Core Course – II(CC)	Microbial Physiology	22UMB2CC2	5	5	3	25	75	100
		Core Practical - II (CP)	Microbial Physiology (P)	22UMB2CC2P	3	3	3	40	60	100
		Core Course – III (CC)	Microbial Diversity	22UMB2CC3	3	3	3	40	60	100
		First Allied Course- III (AC)	Applied Biochemistry	22UMB2AC3	4	3	3	25	75	100
	IV	Ability Enhancement Compulsory Course -II (AECC)	Environmental Studies	22UGEVS	2	2	-	100	-	100
Ability Enhancement Compulsory Course – III (AECC)		Innovation and Entrepreneurship	22UGIE	2	1	-	100	-	100	
		Extra Credit Course	SWAYAM	As Per UGC Recommendation						
<b>Total</b>					<b>30</b>	<b>23</b>				<b>800</b>

<b>Semester: II</b>	<b>Internal Marks: 25</b>		<b>External Marks: 75</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB2CC2</b>	<b>MICROBIAL PHYSIOLOGY</b>	<b>CORE COURSE</b>	<b>5</b>	<b>5</b>

### Course Objective

- To provide basic knowledge nutritional requirements of microbes
- To understand microbial growth and its measurement
- To impart knowledge about carbohydrate and protein metabolism
- To learn the pathways and its importance

### Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

CO Number	CO Statement	Cognitive level
CO 1	State the Nutritional requirements of microorganisms and its uptake	K1, K2
CO 2	Explain different phases of growth and its assessment	K2, K3
CO 3	Describe the Carbohydrate metabolism	K4
CO 4	Illustrate the Protein Metabolism	K3, K4
CO 5	Compute the importance of Anaerobic Respiration and fermentation pathway	K5

### Mapping of CO with PO and PSO

COS	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	2	2	3	3	3	2	2	3	2	3
CO2	3	3	2	3	3	2	2	3	3	3
CO3	2	3	3	2	3	3	3	2	3	3
CO4	2	3	3	3	2	3	2	3	3	3
CO5	3	3	2	3	3	3	3	2	3	3

“1” – Slight (Low) Correlation  
 “3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation  
 “-“ indicates there is no correlation

### Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	<b>Nutrition:</b> Nutritional requirement of microorganisms – micro and macro elements, nutritional classification (Autotrophs, heterotrophs, photoautotrophs, chemoautotrophs, chemolithotrophs, oligotrophs). Uptake of nutrients by the cell – Passive diffusion, Facilitated diffusion, Active transport and group translocation – Iron uptake.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
II	<b>Growth:</b> Phases of Growth, Growth curve. Factors influencing the growth of microorganisms – temperature, pH, salt, Osmotic pressure, and radiations. Synchronous growth- continuous growth and Diauxic culture. Quantitative measurement of growth- Direct microscopic method, Direct plate count, membrane filter count, turbidometry and micrometry.	18	CO1, CO2, CO3, CO4	K1, K2, K3, K4
III	<b>Carbohydrate metabolism:</b> Anabolism – photosynthesis – oxygenic – anoxygenic, synthesis of carbohydrate– catabolism of glucose – Embden Mayer– Hoff – Parnas pathway (EMB) – Pentose pathway, Entener- Doudoroff (ED) pathway, Kreb’s cycle (TCA) – Electron Transport System and ATP production. <b>Respiration:</b> Anaerobic Respiration – Nitrate, sulphate & Methane respiration – Fermentations – alcohol, mixed acid, lactic acid fermentation	18	CO1, CO2, CO3, CO4	K1, K2, K3, K4
IV	<b>Protein metabolism</b> – metabolic pathways of nitrogen utilization, synthesis of amino acids (Proline, glycine, threonine), peptides, proteins. Biosynthesis of bacterial cell wall.	12	CO1, CO2, CO3, CO4	K1, K2, K3, K4
V	<b>Lipid metabolism</b> – biosynthesis of saturated and unsaturated fatty acids and degradation of fatty acids - $\beta$ Oxidation - <b>Nucleic acid metabolism</b> – biosynthesis and degradation of purines and pyrimidines.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	<b>Self Study for Enrichment (Not to be included for End Semester Examination)</b> Bacterial enzymes – classification – Enzymes of aerobic & anaerobic respiration – role of enzymes in metabolism of carbohydrate, protein and lipid.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

## **Text books**

1. Dubey RC and Maheswari DK. (2015). A Text Book of Microbiology. 5th Edition. S Chand, New Delhi.
2. Ananthanarayan Paniker (2020). A Text book of Microbiology. 11th Edition. University Press. Singapore.
3. Madigan MT, Martinko JM, and Parker J.(2019). Biology of Microorganisms. 12th Edition, MacMillan Press. England.
4. Atlas RA and Bartha R.(2019). Microbial Ecology. Fundamentals and Application. 4th edition Benjamin Cummings, New York.
5. Pelczar MJ, Chan ECS and Kreig NR. (2015). Microbiology, 5th edition. McGraw-Hill. Book Co. Singapore.
6. Meenakumari S, Microbial Physiology (2006), Volume 1, MJP Publishers.
7. Alber G. Moat, John W. Foster , Michael P. Spector Microbial Physiology (2002), 4<sup>th</sup> Edition, Wiley-Liss.

## **Reference Books**

1. Tortora GJ, Funke BR and Case CL.(2020). Microbiology: An Introduction. 9th Edition, Pearson Education, Singapore.
2. Black JG. (2018). Microbiology-principles and explorations, 6th edition. John Wiley and Sons, Inc. New York.
3. MoselioSchaechter and Joshua Leaderberg (2019). The Desk encyclopedia of Microbiology. 2<sup>nd</sup> edition. Elsevier Academic press, California.
4. Madigan MT, Martinko JM, and Parker J.(2019). Biology of Microorganisms, 12th Edition. MacMillan Press, England.
5. Michel Mandigan, Kelly S.Bender, Daniel buckley, W Mathew Sattley and David Stahl (2019) Borck biology of miccroorganisms 15<sup>th</sup> Edition, Pearson.
6. Prescott L.M, Harley,J.P. and Helin, D.A. (2017). Microbiology, 5th Edition. McGraw Hill.

## **Web References**

1. [https://uomustansiriyah.edu.iq/media/lectures/6/6\\_2017\\_08\\_09!09\\_50\\_48\\_AM.pdf](https://uomustansiriyah.edu.iq/media/lectures/6/6_2017_08_09!09_50_48_AM.pdf)
2. <https://biologydictionary.net/anaerobic-respiration/>
3. [https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A\\_Microbiology\\_\(Kaiser\)/Unit\\_7%3A\\_Microbial\\_Genetics\\_and\\_Microbial\\_Metabolism/18%3A\\_Microbial\\_Metabolism/18.3%3A\\_Aerobic\\_Respiration](https://bio.libretexts.org/Bookshelves/Microbiology/Book%3A_Microbiology_(Kaiser)/Unit_7%3A_Microbial_Genetics_and_Microbial_Metabolism/18%3A_Microbial_Metabolism/18.3%3A_Aerobic_Respiration)
4. [https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals\\_of\\_Biochemistry\\_\(LibreTexts\)/02%3A\\_Unit\\_II-\\_Bioenergetics\\_and\\_Metabolism/22%3A\\_Biosynthesis\\_of\\_Amino\\_Acids\\_Nucleotides\\_and\\_Related\\_Molecules/22.02%3A\\_Biosynthesis\\_of\\_Amino\\_Acids](https://bio.libretexts.org/Bookshelves/Biochemistry/Fundamentals_of_Biochemistry_(LibreTexts)/02%3A_Unit_II-_Bioenergetics_and_Metabolism/22%3A_Biosynthesis_of_Amino_Acids_Nucleotides_and_Related_Molecules/22.02%3A_Biosynthesis_of_Amino_Acids)
5. <https://www.youtube.com/watch?v=9CPIs-Qhg-M>



**Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

**Course Designer**

Dr. P.Bhuvaneswari

<b>Semester: II</b>	<b>Internal Marks: 40</b>		<b>External Marks: 60</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB2CC2P</b>	<b>MICROBIAL PHYSIOLOGY (P)</b>	<b>CORE PRACTICAL</b>	<b>3</b>	<b>3</b>

### Course Objective

- To enable the students to understand the basic knowledge of
- To acquire adequate skill to handle microscope to visualize microbes.

### Course Outcomes and Cognitive Level Mapping

On the successful completion of the course, students will be able to

CO Number	CO Statement	Cognitive level
CO 1	Develop the skills to grow microbes in the laboratory	K1
CO 2	Illustrate effect of pH, temperature and salt on microbes	K2
CO 3	Measure the growth of microbial cell	K3
CO 4	Summarize biochemical test to identify the bacteria	K3
CO 5	Interpret the results of biochemical reaction by microbes	K4

### Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
<b>CO1</b>	3	2	2	3	3	3	2	2	2	3
<b>CO2</b>	3	2	3	3	2	3	2	2	3	3
<b>CO3</b>	3	3	3	2	3	3	3	3	3	2
<b>CO4</b>	3	3	2	3	2	3	2	2	3	2
<b>CO5</b>	3	3	3	2	3	3	3	3	3	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

### Syllabus

1. Effect of pH on the growth of microbes
2. Effect of Temperature on the growth of microbes
3. Effect of salt on the growth of microbes
4. Determination of growth curve – spectrophotometric assay
5. Measurement of microbial cell by micrometry
6. Cultivation of anaerobes- Wrights tube method and McIntosh method
7. Oxidase test
8. Catalase test
9. Biochemical test -Indole test, Methyl Red test, Voges Proskauer test, Citrate Utilization test, Triple Sugar Iron test and Carbohydrate fermentation test

## Reference Books

1. Bharti Arora, D.R. Arora (2020), *Practical Microbiology*, CBS Publishers & Distributors
2. Mudili J (2020), *Introductory Practical Microbiology*, NarosaDas S (2020), *Microbiology Practical Manual*, CBS Publishers
3. Saravanan R , D. Dhachinamoorthi , CH. MM. Prasada Rao , (2019), *A Handbook of Practical Microbiology*, LAP LAMBERT Academic Publishing.
4. Shukla Das and RumpaSaha (2019). *Microbiology Practical Manual*, 1st Edition CBS Publishers and Distributors.
5. Amita Jain , Jyotsna Agarwal , Vimala Venkatesh (2018), *Microbiology Practical Manual*, 1<sup>st</sup> Edition, Elsevier India.
6. Cappuccino and Sherman (2016), *Microbiology – A Laboratory Manual*, 11th Edition, Dorling Kindersley (India) Pvt. Ltd., New Delhi.
7. R.C.Dubey, Dr.D.K. Maheswari (2010), *Practical Microbiology*, Kindle Edition

## Web References

1. <https://www.youtube.com/watch?v=yDAcepSV-tU>
2. <https://www.youtube.com/watch?v=qGkpW5W25K0>
3. <https://www.jove.com/v/10511/growth-curves-generating-growth-curves-using-colony-forming-units>
4. [https://bio.libretexts.org/Courses/North\\_Carolina\\_State\\_University/MB352\\_General\\_Microbiology\\_Laboratory\\_2021\\_\(Lee\)/07%3A\\_Microbial\\_Metabolism/7.01%3A\\_Introduction\\_to\\_Biochemical\\_Tests\\_Part\\_I](https://bio.libretexts.org/Courses/North_Carolina_State_University/MB352_General_Microbiology_Laboratory_2021_(Lee)/07%3A_Microbial_Metabolism/7.01%3A_Introduction_to_Biochemical_Tests_Part_I)
5. <https://www.youtube.com/watch?v=gkZ1CMKeP0w>
6. <https://microbiologyinfo.com/category/biochemical-test/>

## Pedagogy

Power point presentations, Group Discussion, Quiz, Brain Storming Activity.

## Course Designer

Dr.P.Bhuvaneshwari

<b>SEMESTER: I</b>	<b>INTERNAL MARKS :25</b>		<b>EXTERNAL MARKS : 75</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>Hrs./Week</b>	<b>CREDITS</b>
<b>22UMB2CC3</b>	<b>MICROBIAL DIVERSITY</b>	<b>CORE COURSE</b>	<b>3</b>	<b>3</b>

### Course Objective

- To make the students to understand the different aspects to the classification of Prokaryotes and Eukaryotes.
- To make the students knowledgeable on the diversity of microbes.
- To in-depth an on knowledge on the different groups and species of microbes

### Course Outcome and Cognitive level Mapping

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Cognitive level</b>
CO 1	Remember taxonomy and classification of microorganisms	K1, K2
CO 2	Apply in the field study about viruses classification	K3
CO 3	Analyze characteristics of different groups of microorganisms	K4
CO 4	Evaluate applications of diversified microorganisms	K5
CO 5	Create knowledge on microbial taxonomy and diversity	K6

### Mapping of CO with PO and PSO

<b>COs</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
CO1	3	3	1	2	3	3	3	3	2	3
CO2	3	2	3	3	2	2	3	2	3	3
CO3	3	2	2	3	3	3	2	3	3	2
CO4	2	3	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	3	3	2	2

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial ( High) Correlation

“-“ indicates there is no correlation

### Syllabus

<b>UNIT</b>	<b>CONTENT</b>	<b>HOURS</b>	<b>COs</b>	<b>COGNITIVE LEVEL</b>
I	General Classification : General principles of classification of microorganisms – Haekel’s three	09	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.

	kingdom concept –Whittaker’s five kingdom concept – three domain concept of Carl Woese. Evolutionary methods in classification - International codes of nomenclature - Taxonomic approaches and Phylogeny			
II	Virology: Classification and salient features of viruses. Nature and properties in relation to classification. Structure and in-depth study of T <sub>4</sub> , λ, M <sub>13</sub> . Brief outline on virions and Prions.	09	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.
III	Bacteriology: Classification and salient features of bacteria according to Bergey’s manual of determinative bacteriology, In-depth study of <i>E. coli</i> , <i>Rhizobium</i> sp., <i>Rhodomicrobium</i> sp., Methane oxidizing bacteria <i>Methanobacteriasp.</i> ,	09	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.
IV	Phycology and Mycology : Classification and salient features of algae – nutrition, thallus characteristics and reproduction. Characteristics of green algae, diatoms, euglenoids, brown Rhodophyta, pyrrophyta. Economic importance of algae. Principles and outline classification of fungi: <i>Myxomycetes</i> , <i>Ascomycetes</i> , <i>Basidiomycetes</i> , <i>Deuteromycetes</i> , <i>Zygomycetes</i> , <i>Acrasiomycete</i> sand <i>Oomycetes</i> . In-depth study of <i>Aspergillus</i> sp., <i>Candida</i> sp., <i>Mucor</i> sp. Economic importance of fungi.	09	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.
V	Protozoology : Principles and outline classification of protozoa: Sarcodina, Mastigophora, Ciliata and Sporozoa. Structure and in-depth study of <i>Entamoebahistoltytica</i> and <i>Plasmodium vivax</i> .	09	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.
VI	<b>Self Study Enrichment (Not to be included for External Examination)</b> General Classification of Microbes, taxonomy and diversity of different	-	CO1,CO2, CO3,CO4, CO5.	K1, K2, K3, K4, K5.

	microorganisms, execute field projects on the diversity of microorganisms.			
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### **Text Books**

1. Pelczar, Jr., Michael, E. C. S. Chan and Noel Kreig. (2000). Microbiology. V Ed. Tata McGraw Hill Book Company.
2. Alexopoulos, C.J. and Mims, C.W. (1979). Introductory Mycology, John Wiley, New York.
3. Lansing M. Prescott, John P. Harley and Donald A. Klein. 2002. Microbiology. V Ed. WCB/McGraw Hill Company. pp: 335 to 553.
4. John G. Holt. 1994. Bergey's Manual of Determinative Bacteriology. Lippincott Williams and Wilkins. Pp: 351-352; 597-724.
5. Dubey H. C. 1978. A Textbook of Fungi, Bacteria and Viruses. Vikaas Publishing House Ltd. Ltd. Pp: 1-341.

### **Reference Books**

1. Jeffery C. Pommerville (2016). Alcamo's Fundamentals of Microbiology (Third Edition). Jones and Bartlett Learning. LLC, Burlington, MA 01803.
2. HansG. Schlegel. 2012. General Microbiology. VII Ed. Cambridge

### **Web Reference**

1. <http://www.microbiologyonline.org.uk/links.html>
2. <http://www.bac.wise.edi/microtextbook/index.php>
3. <http://www.microbeworld.org.uk>
4. <http://www.staff.ncl.ac.uk/n.y.morris/lectures/class2007.html>

### **Pedagogy**

Chalk and talk, PPT, Discussion, Assignment, Demo, Quiz, Seminar.

### **Course Designer**

Dr.V.Aruna

<b>Semester: II</b>	<b>Internal Marks: 25</b>		<b>External Marks: 75</b>	
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UMB2AC3</b>	<b>APPLIED BIOCHEMISTRY</b>	<b>FIRST ALLIED COURSE</b>	<b>4</b>	<b>3</b>

### Course objective

- To know about the Types of Blood cells, composition, function, deficiency diseases of RBC and WBC.
- To enable the students to know about the structural features of plasma membrane, cellular transport mechanisms with specific examples.
- To know about the Endocrine glands and its structure, classification of Hormones and its biosynthesis, functions and deficiency diseases.
- Acquire the knowledge about the structure and function of plant hormones and secondary metabolites-Alkaloids and flavonoids.

### Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

<b>CO</b>	<b>CO Statement</b>	
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Number		Cognitive level
CO 1	Illustrate the basic Concept of Blood and its components, Deficiency Diseases	K2
CO 2	Explain the various models of cell Membrane and transport mechanisms	K2
CO 3	List out the Endocrine Glands and their hormones with deficiency diseases	K3
CO 4	Compare the Plant pigments with their biosynthesis and significance	K4
CO 5	Determine the structure of Plant hormones with its structure and function	K5

### Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3	2	3	2	2	3
CO2	2	2	3	2	2	3	2	3	3	3
CO3	3	2	1	3	2	2	2	3	2	2
CO4	2	2	3	2	3	3	3	2	3	2
CO5	3	3	2	3	2	3	2	3	2	3

“1” – Slight (Low) Correlation

“2” – Moderate (Medium) Correlation

“3” – Substantial (High) Correlation

“-“ indicates there is no correlation

### Syllabus

UNIT	CONTENT	HOURS	COS	CONGNITIVE LEVEL
I	Haematology: Types of Blood cells – origin - Composition characterization and coagulation- RBC –Formation – Haemoglobin - Structure and function – Deficiency diseases – Anaemia – Types – WBC – Types – Structure and function – Role in immunity – Leukopenia	12	CO1, CO2 CO3, CO4	K1,K2,K3,K4
II	Cytochemistry – structure and biochemical composition of plasma membrane – fluid mosaic model, Trilaminarmodel. Transport mechanisms –Active, Passive and Facilitated diffusion- Uni, sym and antiports – Na <sup>+</sup> - K <sup>+</sup> ATPase and	12	CO2,CO3, CO4,CO5	K2,.K3,K4,K5



	mitochondrial Calcium transport			
III	Endocrine glands – pituitary, thyroids, parathyroid, pancreas, adrenal, testis and ovary. Hormones – Definition – classification –protein hormone, steroid hormones, functions, regulations, diseases associated with deficiency of hormones.	12	CO1,CO3, CO4,CO5	K1,K3,K4,K5
IV	Structure and functions of plant hormones - Auxins, Gibberellin, Cytokinin and Absciscic acid.	12	CO1,CO2, CO3,C05	K2,K3,K4,K5
V	Plant pigments – chlorophyll, carotenoids- astaxanthin, Phycobilins and anthocyanin structure - Biosynthesis - functions	12	CO1,CO2,C O3,C04	K1,K3,K4,K5
VI	<b>Self Study for Enrichment (Not to be included for End Semester Examination)</b> Hemophilia-Leucocytosis- Polycythemia-Thalassemia- Van willebrand disease	-	CO1, CO2, CO3, C04	K1, K3, K4, K5

### Text Books

1. William, J.Marshall and Stephan, K.Bangert.2014. 3<sup>rd</sup> Edition. Clinical Biochemistry – Metabolic and Clinical Aspects – Churchill Livingston, New York.
2. Ambika Shanmugam.2016. Biochemistry for Medical Students.8<sup>th</sup> Edition. Wolters Kluwer India Pvt. Ltd.
3. Satyanarayana.U. 2020.Biochemistry.5<sup>th</sup> Edition. Elsevier. RELX India pvt. ltd,
4. Seema Pavgi Upadhye.2020. Textbook of Biochemistry.4<sup>th</sup> Edition. Dreamtech Press.
5. Harper's.2018. Illustrated Biochemistry.31<sup>st</sup> Edition. McGraw Hill / Medical Publishers.

### References

1. Stryer, L.1995.Biochemistry. 4<sup>th</sup> Edition. W.H. Freeman and Company, New York.
2. Dinesh puri.2020. Textbook of Medical Biochemistry.4<sup>th</sup> Edition. Elsevier India
3. Donald voet and Judith voet.1990. Biochemistry. John Wiley and Sons, New York.
4. Hubert, Stryer, 1995. Biochemistry – Freeman and Company, New York.
5. Dawn, B.Markus, 1994. Biochemistry.Harwal Publishing, New York.

### Web References

1. <https://byjus.com/neet/plant-hormones/>
2. <https://www.hopkinsmedicine.org/health/conditions-and-diseases/hormones-and-the-endocrine-system>
3. <https://byjus.com/neet/types-of-blood-cells-notes/>

**Pedagogy**

Power point presentations, Group Discussion, Brain Storming Activity.

**Course Designer**

Dr.N.Pushpa

<b>Semester : II</b>	<b>Internal Marks: 100</b>			
<b>COURSE CODE</b>	<b>COURSE TITLE</b>	<b>CATEGORY</b>	<b>HRS/WEEK</b>	<b>CREDITS</b>
<b>22UGEVS</b>	<b>ENVIRONMENTAL STUDIES</b>	<b>ABILITY ENHANCEMENT COMPULSORY COURSE</b>	<b>2</b>	<b>2</b>

### Course Objective

To train the students to get awareness about total environment and its related problems and to make them to participate in the improvement and protection of the environment.

### Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to

<b>CO Number</b>	<b>CO Statement</b>	<b>Cognitive Level</b>
CO1	Outline the nature and scope of environmental studies	K1, K2
CO2	Illustrate the various types of natural resources and its importance.	K2
CO3	Classify various types of ecosystem with its structure and function.	K2, K3
CO4	Develop an understanding of various types of pollution and biodiversity.	K3
CO5	List out the various types of social issues related with environment and explain protection acts	K4, K5

### Mapping of CO with PO and PSO

<b>Cos</b>	<b>PSO1</b>	<b>PSO2</b>	<b>PSO3</b>	<b>PSO4</b>	<b>PSO5</b>	<b>PO1</b>	<b>PO2</b>	<b>PO3</b>	<b>PO4</b>	<b>PO5</b>
<b>CO1</b>	2	2	2	3	3	2	2	3	2	3
<b>CO2</b>	3	3	2	3	3	3	2	3	3	3
<b>CO3</b>	2	3	3	2	3	3	3	3	3	2
<b>CO4</b>	2	3	3	3	2	3	2	3	3	3
<b>CO5</b>	3	3	2	3	3	3	3	2	3	3

“1” – Slight (Low) Correlation

“3” – Substantial (High) Correlation

“2” – Moderate (Medium) Correlation

“-“ indicates there is no correlation

## Syllabus

UNIT	CONTENT	HOURS	COS	COGNITIVE LEVEL
I	Introduction to environmental studies Definition, scope and importance. Need for public awareness	06	CO1, CO2, CO3, CO4	K1, K2, K3,
II	Natural Resources: Renewable and non-renewable resources: Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people. Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems. Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources. Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity. Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources. Case studies. Land resources: Land as resources, land degradation, man induced Landslides, soil erosion and desertification. Role of an individual in conservation of natural resources.	06	CO1, CO2, CO3, CO4	K1, K2, K3
III	Ecosystems Concept, Structure and function of an ecosystem. Producers, consumers and decomposers Energy flow in the ecosystem and Ecological succession. Food chains, food webs and ecological pyramids Introduction, types, characteristic features, structure and function of the following ecosystem:-Forest ecosystem, Grassland ecosystem and Desert ecosystem, Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)	06	CO1, CO2, CO3, CO4	K1, K2, K3

IV	<p>Biodiversity and Environmental Pollution Introduction, types and value of biodiversity. India as a mega diversity nation. Hot-spots of biodiversity. Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts. Endangered and endemic species of India. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity. Definition, Causes, effects and control measures of:</p> <ol style="list-style-type: none"> <li>a. Air Pollution</li> <li>b. Water Pollution</li> <li>c. Soil Pollution</li> <li>d. Noise pollution</li> <li>e. Nuclear hazards</li> </ol> <p>Solid waste Management: Causes, effects and control measures of urban and industrial wastes. E-Waste Management: Sources and Types of E-waste. Effect of E-waste on environment and human body. Disposal of E-waste, Advantages of Recycling E-waste. Role of an individual in prevention of pollution. Disaster management: floods, earthquake, cyclone and landslides.</p>	06	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	<p>Social Issues and the Environment Water conservation, rain water harvesting, watershed management. Climate change, global warming, acid rain, ozone layer depletion, Wasteland reclamation. Environment Protection Act Wildlife Protection Act. Forest Conservation Act. Population explosion – Family Welfare Programmes Human Rights - Value Education. HIV/ AIDS - Women and Child Welfare. Role of Information Technology in Environment and human health.</p>	06	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

VI	<b>Self-Study for Enrichment (Not to be included for End Semester Examination)</b> Global warming – climate change – importance of ozone – Effects of ozone depletion. Biogeography – history, ecology and conservation. International laws and policy	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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## References

1. Beard, J.M. 2013. Environmental Chemistry in Society (2nd edition). CRC Press.
2. Girard, J. 2013. Principles of Environmental Chemistry (3rd edition). Jones & Bartlett.
3. Brebbia, C.A. 2013. Water Resources Management VII. WIT Press.
4. Pandit, M.K. & Kumar, V. 2013. Land use and conservation challenges in Himalaya: Past, present and future. In: Sodhi, N.S., Gibson, L. & Raven, P.H. Conservation Biology: Voices from the Tropics. pp. 123-133. Wiley-Blackwell, Oxford, UK (file:///Users/mkpandit/Downloads/Raven%20et%20al.%202013.%20CB%20Voices%20from%20Tropics%20(2).pdf) .
5. Hites, R.A. 2012. Elements of Environmental Chemistry (2nd edition). Wiley & Sons.
6. Harnung, S.E. & Johnson, M.S. 2012. Chemistry and the Environment. Cambridge University Press.
7. Boeker, E. & Grondelle, R. 2011. Environmental Physics: Sustainable Energy and Climate Change. Wiley.
8. Forinash, K. 2010. Foundation of Environmental Physics. Island Press.
9. Evans, G.G. & Furlong, J. 2010. Environmental Biotechnology: Theory and Application (2nd edition). Wiley-Blackwell Publications.
10. Williams, D. M., Ebach, M.C. 2008. Foundations of Systematics and Biogeography. Springer
11. Pani, B. 2007. Textbook of Environmental Chemistry. IK international Publishing House.
12. Agarwal, K.C. 2001 Environmental Biology, Nidi Public Ltd Bikaner.

## Pedagogy

Chalk and talk, PPT, Discussion, Assignment, Quiz, Seminar

## Course Designer

Dr.B.Thamilmaraiselvi

## Assessment Rubrics for 100 Marks

1. Documentary (or) Poster Presentation (or) Elocution-25 Marks
2. Quiz (or) MCQ Test-25 Marks
3. Album Making (or) Case study on a topic (or) Field Visit -25 Marks
4. Essay Writing (or) Assignment (Minimum 10 pages) -25 Marks

There will be no End Semester Examination for this course. However, the subject teacher will evaluate the above mentioned components based on the performance of the students and submit the marks out of 100 (in the format to be supplied by the COE) with the approval of the concerned Head of the Department to the COE along with CIA marks of other courses.