



# **K.M.G. COLLEGE OF ARTS AND SCIENCE** **(AUTONOMOUS)**

Approved by the Government of Tamil Nadu  
Permanently Affiliated to Thiruvalluvar University, Vellore  
Recognized under Section 2(f) and 12(B) of the UGC Act 1956  
Accredited by NAAC (2nd Cycle) with (CGPA of 3.24/4) 'A' Grade

## **P.G. & RESEARCH DEPARTMENT OF MICROBIOLOGY**

### **B.Sc., Microbiology**

## **SYLLABUS** **CHOICE BASED CREDIT SYSTEM)**

**Under**

## **LEARNING OUTCOMES-BASED CURRICULUM** **FRAMEWORK (LOCF)**

**(Effective for the Batch of Students Admitted from 2024-2025)**

## PREFACE

The curriculum of Undergraduate Microbiology has been designed to explain the concepts in various fields of Microbiology such as Medical Microbiology, Soil Microbiology, Pharmaceutical Microbiology etc..and also explain both beneficial and harmful organisms. The purpose of the outcome-based education is meant to provide an exposure to the fundamental aspects in different area of Microbiology and its applications, keeping in mind the growing needs for higher education, employability, entrepreneurship and social responsibility. The periodical restructuring of the syllabi is carried out to fulfill the requirements of graduate attributes, qualification descriptors, programme learning outcomes and course outcomes. The outcome-based education enriches the curriculum to deliver the basic principles, synthetic strategies, mechanisms and application-oriented learning for the benefit of students. It also includes self-learning module, minor projects and industrial internship to enable students to get equipped for higher studies and employment. The programme also includes training to students for seminar presentation, preparation of internship reports, hands-on training in lab courses, skills to handle instruments, synthesis and its analysis, developing leadership qualities, organization and participation in the interdepartmental academic competitions. The non-major elective courses offer chances to learn and augment interest in other related fields. The outcome-based curriculum is intended to enrich the learning pedagogy to global standards. ICT enabled teaching-learning platforms are provided to students along with the interaction of international scientists. The exposure to the industrial internship and MoUs with industries can open an avenue for a start-up and its progress would be followed regularly. The OBE based evaluation methods will reflect the true cognitive levels of the students as the curriculum is designed with course outcomes and cognitive level correlations as per BLOOM's Taxonomy.

## **ABOUT THE COLLEGE**

The College was founded in the new millennium 2000 by the vision of late Shri.K.M.Govindarajan fondly known as Iyah, with a mission to offer higher education in the fields of Arts and Science to the needy and the poor middle class students of this area and make them fully employable and economically self-reliant. With a humble beginning of launching an elementary school named Thiruvalluvar Elementary School in the year 1952, Iyah groomed it into a Higher Secondary School and later into a college. Education was his soul and breath. The college has grown into a full-fledged educational hub offering 12 under graduate programmes, 8 post graduate programmes, 5 M.Phil research programmes and 4 Ph.D programmes. The college has been accredited with ‘A’ grade by NAAC in 2nd cycle and recognized under section 2(f) & 12(B) of the UGC act 1956. The College is permanently affiliated to Thiruvalluvar University. The College is also acquired the status of Autonomous from the academic year 2024-2025. The College is an associate member of ICT Academy and registered member of NPTEL and Spoken Tutorials of IIT Bombay. The college is also a member of INFLIBNET and NDL.

## **VISION OF THE COLLEGE**

Empower young men and women by educating them in the pursuit of excellence, character building and responsible citizen.

## **MISSION OF THE COLLEGE**

Offer higher education in the fields of Arts, Science & Management to the needy and make them fully self-dependent.

## **QUALITY POLICY OF THE COLLEGE**

KMG Students achieve the best learning results and personal growth with modern education that equip them for working life and a changing society to become deserving citizens.

## **ABOUT THE DEPARTMENT**

The Department of Microbiology was established in year 2005. The department offers the courses at the UG level and the department upgraded to UG Microbiology into PG Applied Microbiology 2017 -2018 Batch onwards and the department upgraded in Research level (Ph.D) during the Academic Year 2019-2020. Microbiology is a broad discipline that involves a study of classification of Microorganisms, Ecology, and Applications in Agriculture, Food and Medicine. It teaches about microorganisms with particular emphasis on the biology of Bacteria, Viruses, Fungi, Algae and Protozoan Parasites The department is very zealous in providing quality education to the students. The well-equipped UG and PG laboratory and library have made the teaching- learning process more effective.

## **.VISION OF THE DEPARTMENT**

The Vision of the Department of Microbiology is that the knowledge in theory and practical aspects of Microbiology is imperative for the development of students. Upgrading of existing teaching and research activities in order to keep pace with the global scientific progress and to meet the requirements of society

## **.MISSION OF THE DEPARTMENT**

The PG and Research Department of Microbiology considers its mission as to produce personnel with expertise of the highest standard in the field of Microbiology to cater the increasing demand in the country for Microbiologists. Also development of academic processes to enhance scientific research through strategic planning and a clear view for science and technology.

## PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- 1. Professional Excellence:** Graduates will demonstrate competency and excellence in their chosen fields of study, applying theoretical knowledge to practical situations effectively.
- 2. Character Development:** Graduates will exhibit strong moral and ethical character, upholding values of integrity, honesty, and respect for others in both personal and professional endeavors.
- 3. Leadership and Citizenship:** Graduates will emerge as responsible leaders and active citizens, contributing positively to their communities and society at large through their actions and initiatives.
- 4. Continuous Learning:** Graduates will engage in lifelong learning and professional development activities, adapting to evolving technologies, methodologies, and societal needs.
- 5. Self-Dependency and Entrepreneurship:** Graduates will possess the skills and mindset necessary to be self-reliant and entrepreneurial, capable of creating opportunities for themselves and others through innovation and initiative.
- 6. Effective Communication and Collaboration:** Graduates will demonstrate proficiency in communication skills, both verbal and written, and exhibit the ability to collaborate effectively with diverse teams and stakeholders.
- 7. Global Perspective:** Graduates will have a broad understanding of global issues and perspectives, demonstrating cultural sensitivity and adaptability in multicultural environments.

## PROGRAM OUTCOMES (POs)

On successful completion of the programme, the students will be able to:

POs	Graduate Attributes	Statements
PO1	Disciplinary Knowledge	Acquire detailed knowledge and expertise in all the disciplines of the subject.
PO2	Communication Skills	Ability to express thoughts and ideas effectively in writing, listening and confidently Communicate with others using appropriate media
PO3	Critical Thinking	Students will develop aptitude Integrate skills of analysis, critiquing, application and creativity.
PO4	Analytical Reasoning	Familiarize to evaluate the reliability and relevance of evidence, collect, analyze and interpret data.
PO5	Problem Solving	Capacity to extrapolate the learned competencies to solve different kinds of non-familiar problems.
PO6	Employability and Entrepreneurial Skill	Equip the skills in current trends and future expectations for placements and be efficient entrepreneurs by accelerating qualities to facilitate startups in the competitive environment.
PO7	Individual and Team Leadership Skill	Capability to lead themselves and the team to achieve organizational goals and contribute significantly to society.
PO8	Multicultural Competence	Possess knowledge of the values and beliefs of multiple cultures and a global perspective.
PO 9	Moral and Ethical awareness/reasoning	Ability to embrace moral/ethical values in conducting one's life.
PO10	Lifelong Learning	Identify the need for skills necessary to be successful in future at personal development and demands of work place.

## PROGRAM SPECIFIC OUTCOMES (PSOs)

On successful completion of the B.Sc., Microbiology, the students will be able to:

PSOs	Statements
PSO1	Understand the fundamental principles, concepts, and theories related to Microbiology. Also, exhibit proficiency in performing experiments in the laboratory.
PSO2	Formulate research questions, conduct literature reviews, design and execute research studies, communicate research findings and collaborate in research projects.
PSO3	Exhibit ethical conduct, critical thinking, and collaborative skills in addressing scientific challenges and advancing knowledge in Microbiology

### Correlation Rubrics:

High	Moderate	Low	No Correlation
3	2	1	-

### Mapping of PSOs with POs:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
PSO1	3	3	1	3	1	-	2	-	-	2
PSO2	3	2	2	3	2	3	2	2	-	2
PSO3	3	3	3	2	2	3	1	1	3	3

# K.M.G. COLLEGE OF ARTS AND SCIENCE

## (AUTONOMOUS)

### Subject and Credit System- B.Sc., MICROBIOLOGY

(Effective for the Batch of Students Admitted from 2024-2025)

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	MaximumMarks		
							Internal	External	Total
<b>SEMESTER - I</b>	I	Language	AULT10 / AULU10	General Tamil – I / Urdu-I	6	3	25	75	100
	II	English	AULE10	English – I	6	3	25	75	100
	III	Core – 1	AUCMB11	Fundamentals of Microbiology and Microbial diversity	5	5	25	75	100
	III	Core – 2	AUCPMB12	<b>Practical I</b> Fundamentals of Microbiology and Microbial diversity	5	5	25	75	100
	III	Elective-I	AUEMB13	Basic & Clinical Biochemistry	4	3	25	75	100
	IV	SEC-I NME	AUSMB14	Social and Preventive medicine	2	2	25	75	100
	IV	Foundation Course	AUFMB15	Introduction to microbial world	2	2	25	75	100
				<b>Semester Total</b>	<b>30</b>	<b>23</b>			
<b>SEMESTER - II</b>	I	Language	AULT20 / AULU20	General Tamil – II / Urdu-II	6	3	25	75	100
	II	English	AULE20	English – II	6	3	25	75	100
	III	Core - 3	AUCMB21	Microbial Physiology and Metabolism	5	5	25	75	100
	III	Core – 4	AUCPMB22	<b>Practical II</b> -Microbial Physiology and Metabolism	5	5	25	75	100
	III	Elective-II	AUEMB23	Bioinstrumentation	4	3	25	75	100
	IV	SEC II (NME)	AUSMB24	Nutrition & Health Hygiene	2	2	25	75	100
	IV	SEC II III	AUSMB25	Sericulture	2	2	25	75	100
				<b>Semester Total</b>	<b>30</b>	<b>23</b>			



Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	MaximumMarks		
							Internal	External	Total
SEMESTER - III	I	Language	AULT30 / AULU 30	General Tamil – III / Urdu - III	6	3	25	75	100
	II	English	AULE30	English – III	6	3	25	75	100
	III	Core - 5	AUCMB31	Molecular Biology and Microbial Genetics	5	5	25	75	100
	III	Core – 6	AUCPMB32	<b>Practical III</b> -Molecular Biology and Microbial Genetics	5	5	25	75	100
	III	Elective III	AUEMB33	Clinical Laboratory Technology	3	3	25	75	100
	IV	SHC Course IV	AUSMB34	Organic Farming and Biofertiliser technology	1	1	25	75	100
	IV	SHC Course V	AUSMB35	Aquaculture	2	2	25	75	100
	IV	Compulsory	AUES30	Environmental Studies	2	2	25	75	100
					<b>Semester Total</b>	<b>30</b>	<b>24</b>		
SEMESTER - IV	I	Language	AULT40 / AULU 40	General Tamil – IV / Urdu - IV	6	3	25	75	100
	II	English	AULE40	English – IV	6	3	25	75	100
	III	Core - 7	AUCMB41	Immunology & Immunotechnology	5	5	25	75	100
	III	Core – 8	AUCPMB42	Practical IV -Immunology &Immunotechnology	5	5	25	75	100
	III	Elective IV	AUEMB43	Food Processing Technology	3	3	25	75	100
	IV	SHC Course VI	AUSMB44	Vaccine Technology	3	2	25	75	100
	IV	SHC Course VII	AUSMB45	Apiculture	2	2	25	75	100
					<b>Semester Total</b>	<b>30</b>	<b>23</b>		

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	MaximumMarks		
							Internal	External	Total
<b>SEMESTER - V</b>									
SEMESTER - V	III	Core – 9	AUCMB51	Bacteriology & Mycology	5	4	25	75	100
	III	Core – 10	AUCMB52	Virology & Parasitology	5	4	25	75	100
	III	Core – 11	AUCPMB53	Practical V : Bacteriology ,Mycology, Virology & Parasitology	5	4	25	75	100
	III	Core – 12	AUPMB54	Project with Viva-voce	4	3	25	75	100
	III	Elective V	AUEMB55	Recombinant DNA Technology	5	4	25	75	100
	III	Elective VI	AUEMB56	Biosafety and Bioethics	4	3	25	75	100
	IV	Compulsory	AUVE50	Value Education	2	2	25	75	100
	IV	Compulsory	AUIMB57	Internship/Industrial Training (Carried out in II-Year Summer vacation) (30hours)	-	2	100	-	100
				<b>Semester Total</b>	<b>30</b>	<b>26</b>			
<b>SEMESTER - VI</b>									
SEMESTER - VI	III	Core – 13	AUCMB61	Environmental and Agriculture Microbiology	6	4	25	75	100
	III	Core – 14	AUCMB62	Food,Dairy and Probiotic Microbiology	6	4	25	75	100
	III	Core – 15	AUCPMB63	Practical VI : Environmental , Agriculture, Food,Dairy and Probiotic Microbiology	6	4	25	75	100
	III	Elective VII	AUEMB64	Pharmaceutical Microbiology	5	3	25	75	100
	III	Elective VIII	AUEMB65	Entrepreneurship and Bio business	5	3	25	75	100
	IV	Compulsory	AUEA60	Extension Activity	0	1	100	-	100
	V	Compulsory	AUPCMB66	Microbial Quality Control and Testing	2	2	25	75	100
					<b>Semester Total</b>	<b>30</b>	<b>21</b>		

**Consolidated Semester wise and Component wise Credit distribution**

<b>Parts</b>	<b>Semester-I</b>	<b>Semester-II</b>	<b>Semester-III</b>	<b>Semester-IV</b>	<b>Semester-V</b>	<b>Semester-VI</b>	<b>Total Credits</b>
<b>Part-I</b>	3	3	3	3	-	-	12
<b>Part-II</b>	3	3	3	3	-	-	12
<b>Part-III</b>	13	13	13	13	22	18	92
<b>Part-IV</b>	4	4	5	4	4	1	22
<b>Part-V</b>	-	-	-	-	-	2	2
<b>Total</b>	23	23	24	23	26	21	<b>140</b>

\*Part I, II, and Part III components will be separately taken into account for CGPA calculation and classification for the under graduate programme and the other components. IV, V has to be completed during the duration of the programme as per the norms, to be eligible for obtaining the UG degree.

Methods of Evaluation		
<b>Internal Evaluation</b>	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance & Class Participation	
<b>External Evaluation</b>	End semester Examination	75Marks
	Total	100 Marks
Methods of Assessment		
<b>Recall (K1)</b>	Simple definitions ,MCQ, Recall Steps Concepts Definitions	
<b>Understand /Compared (K2)</b>	MCQ, True / False, Short Essays , Concept Explanation ,Short summary or Overview	
<b>Application (K3)</b>	Suggest Idea / Concepts With Examples , Suggest Formulate ,Solve Problems, Observe , Explain	
<b>Analysis (K4)</b>	Problem –Solving Questions, Finish a Procedure in many steps, differentiate between Various Ideas, and map Knowledge.	
<b>Evaluate (K5)</b>	Longer Essay / Evaluation Essay Critique Or Justify with pros & Cons	
<b>Create (K6)</b>	Check knowledge in specific or offbeat situations ,discussion , debating or Presentations	

### Question Paper Pattern Theory

External Maximum 75 Marks – wherever applicable (Ext.75 + Int.25 = Total. 100)			
<b>Section A</b>	Very short answer questions	10X 2=20	10 questions – 2 from each unit
<b>Section B</b>	Short answer questions of either / or type (like 1a (or) 1b)	5X5=25	5 questions – 1 from each unit
<b>Section C</b>	Essay-type questions / Problem (Answer any 3 out of 5)	3X10=30	5 questions – 1 from each unit

**Question Paper Pattern Practical**

<b>External Maximum 75 Marks – wherever applicable (Ext.75 + Int.25 = Total. 100)</b>	
<b>Major Practical</b>	1X 30=30 marks
<b>Minor Practical</b>	1X20=20 Marks
<b>Spotters</b>	5X3=15 Marks
<b>Record</b>	10 Marks
<b>Total</b>	75 Marks

### COURSE DESCRIPTORS

<b>Title of the Course</b>	<b>Fundamentals of Microbiology and Microbial Diversity</b>	<b>Hours/Week</b>	05
<b>Course Code</b>	AUCMB11	<b>Credits</b>	05
<b>Category</b>	Core-1	<b>Year &amp; Semester</b>	I & I
<b>Prerequisites</b>	BIOLOGY	<b>Regulation</b>	2024

#### Objectives of the course:

- *Learn the fundamental principles about different aspects of Microbiology including recent Developments in the area.*
- *Describe the structural organization, morphology and reproduction of microbes.*
- *Explain the methods of cultivation of microbes and measurement of growth.*
- *Understand the microscopy and other basic laboratory techniques – culturing, disinfection and sterilization in Microbiology.*
- *Compare and contrast the different methods of sterilization.*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	History and Evolution of Microbiology, Classification – Three kingdom, five kingdom, six kingdom and eight kingdom. Microbial biodiversity: Introduction to microbial biodiversity- ecological niche. Basic concepts of Eubacteria, Archaeobacteria and Eucarya. Conservation of Biodiversity.	CO1 CO2	K1 K2 K3
UNIT-II	General characteristics of cellular microorganisms (Bacteria, Algae, Fungi and Protozoa) and acellular microorganisms - (Viruses, Viroids, Prions), Differences between prokaryotic and eukaryotic microorganisms. Structure of Bacterial cell wall, cell membrane, capsule, flagella, pili, mesosomes, chlorosomes, phycobilisomes, spores, and gas vesicles. Structure of fungi (Mold and Yeast), Structure of microalgae.	CO1 CO2 CO3	K1 K2 K3
UNIT-III	Bacterial culture media and pure culture techniques. Mode of cell division, Quantitative measurement of growth. Anaerobic culture techniques.	CO3 CO4 CO5	K1 K2 K3

<b>UNIT-IV</b>	Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM, Confocal microscopy, and Atomic Force Microscopy. Stains and staining methods.	CO1 CO2 CO3 CO4	K1 K2 K3 K4
<b>UNIT-V</b>	Sterilization–moist heat - autoclaving, dry heat – Hot air oven, radiation – UV, Ionization, filtration – membrane filter and disinfection, antiseptic; Antimicrobial agents.	CO1 CO3 CO5	K1 K2 K3 K4

**Recommended Text Books**

1. Pelczar.M. J., Chan E.C.S. and Noel. R.K. (2007). *Microbiology. 7<sup>th</sup>Edition.,McGraw –Hill, New York.*
2. Willey J., Sherwood L., and Woolverton C. J., (2017). *Prescott’s Microbiology. 10<sup>th</sup> Edition., McGraw-Hill International edition*
3. Tortora, G.J., Funke, B.R., Case,C.L. (2013). *Microbiology. An Introduction 11<sup>th</sup>Edition., A La Carte Pearson.*
4. Salle. A.J (1992). *Fundamental Principles of Bacteriology. 7<sup>th</sup>Edition., McGraw Hill Inc.NewYork.*
5. Boyd, R.F. (1998). *General Microbiology,2<sup>nd</sup>Edition., Times Mirror, Mosby CollegePublishing, St Louis.*

**Reference Books**

1. Jeffrey C. Pommerville., *Alcamo’s Fundamentals of Microbiology (9<sup>th</sup>Edition). Jones &Bartlett learning 2010.*
2. Stanier R.Y, Ingraham J. L., Wheelis M. L., and Painter R. R. (2010). *General Microbiology, 5<sup>th</sup>Edition., MacMillan Press Ltd*
3. Nester E., Anderson D., Roberts C. E., and Nester M. (2006). *Microbiology-A Human Perspective, 5<sup>th</sup>Edition., McGraw Hill Publications.*
4. Madigan M.T., Martinko J.M., Stahl D.A, and Clark D. P. (2010). *Brock - Biology of Microorganisms, 13<sup>th</sup> Edition Benjamin-Cummings Pub Co.*

**Website and e-learning source**

- 1) <https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>
- 2) <https://bio.libretexts.org/@go/page/9188>
- 3) <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#4>
- 4) <https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the historical events that led to the discoveries and inventions and understand the Classification of Microorganisms.	K1,K2,K3
CO2	Build Knowledge of detailed structure and functions of prokaryotic cell organelles.	K1,K2,K3
CO3	Understand the various microbiological techniques, and make use to distinguish types of media, and techniques involved in culturing microorganisms.	K1,K2,K3
CO4	Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application.	K1,K2,K3,K4
CO5	Understand the concept of asepsis and modes of sterilization and disinfectants.	K1,K2,K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	3	-	-	-	3	3	3	3
CO2	3	1	1	2	-	2	-	-	-	2	3	2	2
CO3	3	2	2	2	-	3	-	2	-	3	3	3	3
CO4	3	2	3	2	3	2	-	-	-	2	3	2	3
CO5	3	2	3	2	2	2	-	-	-	2	3	2	2



**COURSE DESCRIPTORS**

<b>Title of the Course</b>	<b>Practical I - Fundamentals Of Microbiology And Microbial Diversity</b>	<b>Hours/Week</b>	05
<b>Course Code</b>	AUCPMB12	<b>Credits</b>	05
<b>Category</b>	Core Course II- Practical I	<b>Year &amp; Semester</b>	I & I
<b>Prerequisites</b>	Biology	<b>Regulation</b>	2024

**Objectives of the course:**

- *Acquire knowledge on Cleaning of glass wares, GLP and sterilization.*
- *Gain knowledge on media preparation and cultural characteristics.*
- *Learn the pure culture technique*
- *Learn the microscopic techniques and staining methods.*
- *Acquire knowledge on stain and staining methods*

<b>UNITS</b>	<b>Contents</b>	<b>COs</b>	<b>Cognitive Levels</b>
<b>UNIT-I</b>	Cleaning of glass wares, Microbiological good laboratory practice and safety. Sterilization and assessment of sterility– Autoclave, hot air oven, and membrane filtration.	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5
<b>UNIT-II</b>	Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates.	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5
<b>UNIT-III</b>	Preparation of basal, differential, enriched, enrichment, transport, and selective media preparation- quality control of media, growth supporting properties, sterility check of media. Pure culture techniques: streak plate, pour plate, decimal dilution.	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5 K6

<b>UNIT-IV</b>	Culture characteristics of microorganisms: growth on different media, growth characteristics, and description. Demonstration of pigment production. Microscopy: light microscopy and bright field microscopy	CO1 CO2 CO3 CO4	K1 K2 K3 K4 K5
<b>UNIT-V</b>	Staining techniques: smear preparation, simple staining, Gram’s staining and endospore staining. Study on Microbial Diversity using Hay Infusion Broth-Wet mount to show different types of microbes, hanging drop.	CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5 K6

**Recommended Text Books**

1. James G Cappucino and N. Sherman MB(1996). *A lab manual Benjamin Cummins, New York 1996.*
2. Kannan. N (1996). *Laboratory manual in General Microbiology. Palani Publications.*
3. Sundararaj T (2005). *Microbiology Lab Manual (1<sup>st</sup> edition) publications.*
4. Gunasekaran, P. (1996). *Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.*
5. R C Dubey and D K Maheswari (2002). *Practical Microbiology. S. Chand Publishing*

**Reference Books**

1. Atlas.R (1997). *Principles of Microbiology, 2<sup>nd</sup> Edition, Wm.C.Brown publishers.*
2. Amita J, Jyotsna A and Vimala V (2018). *Microbiology Practical Manual. (1<sup>st</sup> Edition). Elsevier India*
3. Talib VH (2019). *Handbook Medical Laboratory Technology. (2<sup>nd</sup> Edition). CBS*
4. Wheelis M, (2010). *Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.*
5. Lim D. (1998). *Microbiology, 2<sup>nd</sup> Edition, WCB McGraw Hill Publications*

**Website and e-learning source**

- 1) <http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfection-methods-and-principles-microbiology/24403>
- 2) <https://www.ebooks.cambridge.org/ebook.jsf?bid=CBO9781139170635>
- 3) [https://www.grsmu.by/files/file/university/cafedry//files/essential\\_microbiology.pdf](https://www.grsmu.by/files/file/university/cafedry//files/essential_microbiology.pdf)
- 4) <https://microbiologyinfo.com/top-and-best-microbiology-books/>
- 5) <https://www.cliffsnotes.com/studyguides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

Cos	CO Description	Cognitive Level
CO1	Practice sterilization methods; learn to prepare media and their quality control.	K1,K2.K3,K4
CO2	Learn streak plate, pour plate and serial dilution and pigment production of microbes.	K1,K2,K3,K4,K5
CO3	Understand Microscopy methods, different Staining techniques and motility test.	K1,K2.K3,K4,K5
CO4	Observe culture characteristics of microorganisms.	K1,K2.K3,K4,K5,
CO5	Study on Microbial Diversity using Hay Infusion Broth-Wet mount	K1,K2.K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	3	2	2	2	-	-	2	3	3	3
CO2	3	2	2	2	2	2	2	-	-	2	3	3	2
CO3	3	2	2	2	2	3	2	-	-	2	3	3	3
CO4	3	2	3	2	3	2	2	-	-	3	3	3	2
CO5	3	2	3	2	2	2	2	-	-	2	3	2	3

**COURSE DESCRIPTORS**

<b>Title of the Course</b>	<b>Basic and Clinical Biochemistry</b>	<b>Hours/Week</b>	04
<b>Course Code</b>	AUEMB13	<b>Credits</b>	03
<b>Category</b>	Elective Generic / Discipline Specific Elective-I	<b>Year &amp; Semester</b>	I & I
<b>Prerequisites</b>	Biology	<b>Regulation</b>	2024

**Objectives of the course:**

- *Attain thorough knowledge on carbohydrates and lipids, their characteristic properties and organization in carrying out all the living functions which constitute the life.*
- *Explain the biological activity of amino acids and proteins.*
- *Identify the metabolic errors in enzymes of carbohydrates and lipids.*
- *Describe the disorders in amino acid metabolism.*
- *Interpret the consequences, biochemical, clinical features, diagnosis and treatment of metabolic diseases of day today life.*

<b>UNITS</b>	<b>Contents</b>	<b>COs</b>	<b>Cognitive Levels</b>
<b>UNIT-I</b>	Biomolecules -Carbohydrate – General properties, function, structure, classification– monosaccharides (Glucose, Fructose, Galactose), Oligoaccharides (Sucrose, Maltose, Lactose) and polysaccharides (Starch, Glycogen,) and biological significance. Lipids – General properties, functions, structure, classification (Simple, Derived and Complex), Cholesterol, LDL, HDL – biological significance..	CO1 CO3	K1 K2 K3
<b>UNIT-II</b>	Biomolecules - Amino acids – General properties, functions, structure, classification and biological significance. Proteins– General structure, Properties, functions, classification and biological significance.	CO2 CO4 CO5	K1 K2 K3 K4
<b>UNIT-III</b>	Disorders of Metabolism: Disorders of carbohydrate metabolism: diabetes mellitus,ketoacidosis, hypoglycemia, glycogen storage diseases, galactosemia and lactose intolerance. Disorders of lipid metabolism:hyperlipidemia, hyperlipoproteinemia,hypercholesterolemia, hypertriglyceridemia,sphingolipidosis.	CO2 CO3 CO4 CO5	K1 K2 K3 K4

<b>UNIT-IV</b>	Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias.	CO2 CO3 CO4	K1 K2 K3
<b>UNIT-V</b>	Evaluation of organ function tests: Assessment and clinical manifestations of renal, hepatic, pancreatic, gastric and intestinal functions.  Diagnostic enzymes: Principles of diagnostic enzymology. Clinical significance of aspartate aminotransferase, alanine aminotransferase, creatine kinase, aldolase and lactate dehydrogenase.	CO3 CO5	K1 K2 K3

#### Recommended Text Books

1. Satyanarayana, U. and Chakrapani, U (2014). *Biochemistry, 4th Edition, Made Simple Publisher.*
2. Jain J L, Sunjay Jain and Nitin Jain (2016). *Fundamentals of Biochemistry, 7th Edition, S Chand Company.*
3. Ambika Shanmugam's (2016). *Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd.*
4. Vasudevan. D.M. Sreekumari.S, Kannan Vaidyanathan (2019). *Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers*
5. Jeremy M. Berg, Lubert Stryer, John L. Tymoczko, Gregory J. Gatto (2015). *Biochemistry, 8th edition. WH Freeman publisher.*

#### Reference Books

1. Amit Kessel & Nir Ben-Tal (2018). *Introduction to Proteins: structure, function and Motion. 2nd Edition, Chapman and Hall.*
2. David L. Nelson and Michael M. Cox (2017). *Lehninger Principles of Biochemistry, 7th Edition W.H. Freeman and Co., NY.*
3. Lubert Stryer, Jeremy M. Berg, John L. Tymoczko, Gatto Jr., Gregory J (2019). *Biochemistry. 9th Edition, W.H. Freeman & Co. New York.*
4. Donald Voet, Judith Voet, Charlotte Pratt (2016). *Fundamentals of Biochemistry: Life at the Molecular Level, 5th Edition, Wiley.*
5. Joy PP, Surya S. and Aswathy C (2015). *Laboratory Manual of Biochemistry, Edition 1., Publisher: Kerala agricultural university.*

**Website and e-learning source**

1. <https://www.abebooks.com> › plp
2. <https://kau.in/document/laboratory-manual-biochemistry>
3. <https://metacyc.org>
4. <https://www.medicalnewstoday.com>
5. <https://journals.indexcopernicus.com>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

COs	CO Description	Cognitive Level
CO1	Explain the structure, classification, biochemical functions and significance of carbohydrates and lipids	K1,K2.K3
CO2	Differentiate essential and non-essential amino acids, biologically important modified amino acids and their functions, Illustrate the role, classification of Proteins and recognize the structural level organization of proteins, its functions and denaturation.	K1,K2,K3,K4
CO3	Assess defective enzymes and Inborn errors. Recognize diseases related to carbohydrate and lipid metabolism.	K1,K2.K3,K4
CO4	Discuss and evaluate the pathology of aminoacid metabolic disorders.	K1,K2.K3
CO5	Appraise the imbalances of enzymes in organ function and relate the role of Clinical Biochemistry in screening and diagnosis.	K1,K2.K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	3	-	-	-	3	3	3	2
CO2	3	2	1	2	-	1	-	-	-	2	3	3	2
CO3	3	2	2	2	-	2	-	-	-	3	3	3	3
CO4	3	2	3	2	3	2	-	-	-	2	3	3	2
CO5	3	2	3	2	2	3	-	-	-	1	3	2	2

## COURSE DESCRIPTORS

<b>Title of the Course</b>	<b>Social and Preventive Medicine</b>	<b>Hours/Week</b>	02
<b>Course Code</b>	AUSMB14	<b>Credits</b>	02
<b>Category</b>	<b>Skill Enhancement Course I</b>	<b>Year &amp; Semester</b>	I & I
<b>Prerequisites</b>	Biology	<b>Regulation</b>	2024

### Objectives of the course:

- Describe the concepts of health and disease and their social determinants
- Summarize the health management system
- Know about the various health care services
- Outline the goals of preventive medicine
- Gain knowledge about alternate medicine

UNITS	Contents	COs	Cognitive Levels
UNIT-I	<b>Introduction to social medicine:</b> History of social medicine-concepts of health and disease-social determinants of health and disease-Health and quality of life-Health information system- measures of population health-health policies.	CO1 CO2	K1 K2 K3
UNIT-II	<b>Health management:</b> Applications of behavioral sciences and psychology in health management- nutritional programs for health management-water and sanitation in human health-national programs for communicable and non-communicable diseases- environmental and occupational hazards and their control.	CO2 CO3 CO4	K1 K2 K3
UNIT-III	<b>Health care and services:</b> Health care of the community-information, education, communication and training in health-maternal & child health-school health services- Geriatrics-care and welfare of the aged-mental health-health services through general practitioners.	CO2 CO3 CO4	K1 K2 K3 K4

<b>UNIT-IV</b>	<p><b>Preventive medicine:</b> Introduction- role of preventive medicine- levels of prevention-Risk assessment in communities and vulnerable population –surveillance, monitoring and reporting of disease outbreaks - forecasting and control measures in community setting – early detection methods.</p>	CO2 CO3 CO4	K1 K2 K3 K4
<b>UNIT-V</b>	<p><b>Prevention through alternate medicine:</b> Unani, Ayurveda, Homeopathy, Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary response during SARS and MERS coronavirus, Ebola and novel SARS-COV2 outbreaks.</p>	CO4 CO5	K1 K2 K3

**Recommended Text Books**

1. Park.K (2021). *Textbook of preventive and social medicine, 26<sup>th</sup> edition.* BanarsidasBhanot publishers.
2. Mahajan & Gupta (2013). *Text book of preventive and social medicine, 4<sup>th</sup> edition.* Jaypee brothers medical publishers.
3. Chun-Su Yuan, Eric J. Bieber, Brent Bauer (2006). *Textbook of Complementary and Alternative Medicine. Second Edition.* Routledge publishers.
4. Vivek Jain (2020). *Review of Preventive and Social Medicine: Including Biostatistics. 12<sup>th</sup> edition,* Jaypee Brothers Medical Publishers.
5. LalAdarshPankaj Sunder (2011). *Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher.*

**Reference Books**

1. Howard Waitzkin, Alina Pérez, Matt Anderson (2021). *Social Medicine and the coming Transformation. First Edition.* Routledge publishers.
2. GN Prabhakara (2010). *Short Textbook of Preventive and Social Medicine. Second Edition.* Jaypee publishers.
3. Jerry M. Suls, Karina W. Davidson, Robert M. Kaplan (2010). *Handbook of Health Psychology and Behavioral Medicine.* Guilford Press.
4. Marie Eloïse Muller, Marie Muller, MarthieBezuidenhout, KarienJooste (2006). *Health Care Service Management.* Juta and Company Ltd.
5. Geoffrey Rose (2008). *Rose's Strategy of Preventive Medicine: The Complete.* OUP Oxford.



**Website and e-learning source**

- 1) <https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articles-ppts-list.php>
- 2) [https://www.teacheron.com/online-md\\_preventive\\_and\\_social\\_medicine-tutors](https://www.teacheron.com/online-md_preventive_and_social_medicine-tutors)
- 3) <https://www.futurelearn.com>
- 4) <https://www.healthcare-management-degree.net>
- 5) <https://www.conestogac.on.health-care-administration-and-service-management>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

Cos	CO Description	Cognitive Level
CO1	Identify the health information system	K1,K2.K3
CO2	Associate various factors with health management system	K1,K2,K3
CO3	Choose the appropriate health care services	K1,K2.K3,K4
CO4	Appraise the role of preventive medicine in community setting	K1,K2.K3
CO5	Recommend the usage of alternate medicine during outbreaks	K1,K2.K3

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	1	-	3	-	-	-	3	3	3	3
CO2	3	2	1	2	-	-	-	-	-	2	3	3	2
CO3	3	2	2	2	1	-	-	2	-	3	3	2	3
CO4	3	1	3	2	2	2	-	-	-	2	3	3	2
CO5	3	1	2	2	2	2	-	-	-	2	3	3	2

## COURSE DESCRIPTORS

<b>Title of the Course</b>	<b>Introduction to Microbial World</b>	<b>Hours/Week</b>	02
<b>Course Code</b>	AUFMB15	<b>Credits</b>	02
<b>Category</b>	Foundation Course	<b>Year &amp; Semester</b>	I & I
<b>Prerequisites</b>	Biology	<b>Regulation</b>	2024

### Objectives of the course:

- Describe the discovery of microbial world and development of pure culture techniques
- Learn about distribution of microorganism in nature, diversity and types of Microorganisms.
- Know about the impact of microorganism in environment- Branches of microbiology
- Outline the goals of pure culture techniques
- Gain knowledge about microscopy and staining techniques

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Discovery of microbial world: Establishment of theory of biogenesis, Discovery of viruses.. Establishment of germ theory of diseases and fermentation. Work of Lister and principles of aseptic surgery. Discovery and developments of vaccines and modern chemotherapy. Work of Winogradsky and Beijerinck .Discovery of microorganisms as plant pathogens.	CO1 CO2 CO3 CO4	K1 K2 K3
UNIT-II	Distribution of microorganisms in nature. Diversity in microbial habitat. <b>Types of microorganisms bacteria, Fungi , Virus</b> .Introduction to prokaryotic world, eukaryotic microorganisms, - <b>Actinomycets –Classification Binomial Nomenclature of Microorganism.</b>	CO1 CO2 CO3	K1 K2 K3
UNIT-III	Impact of microorganisms in environment and its impact on human life. Branches of microbiology Thrust areas of microbiology: genetic engineering and biotechnology	CO1 CO2 CO3	K1 K2 K3 K4

<b>UNIT-IV</b>	<p>Definition: Pure culture and axenic culture .Preservation of pure culture, culture collection centers. <b>Pour Plate Technique ,Spread Plate Technique, Calculation methods of Colony Counter.</b></p>	<p>CO1 CO3 CO4</p>	<p>K1 K2 K3 K4</p>
<b>UNIT-V</b>	<p>Techniques used to study microorganisms</p> <p>Microscopy- Principles of microscopy, magnification and resolving power .Light microscopy: simple and compound microscope. Bright Field and dark field microscopy. Principles and application of phase contrast And fluorescent microscopy. Electron microscopy: General principles. Types of electron microscopy,their principles working and limitations.</p> <p>Staining, Dyes and stains: Definition,acidic basic dyes and leucocompounds. Smear:Fixation use of mordent,intensifiers and decolorizer. Mechanism of staining. Types of staining: simple and Differential staining. Application of stains and dyesin study ofmicrobiology</p>	<p>CO1 CO5</p>	<p>K1 K2 K3</p>

**Recommended Text Books**

1. Pelczar MJ, Chan ECS and Kreig NR Tata Mc Grow Hill
2. R C Dubey and D K Maheswari (2002). *Practical Microbiology*. S. Chand Publishing.
3. Willey J., Sherwood L., and Woolverton C. J., (2017). *Prescott’s Microbiology*. 10th Edition., McGraw-Hill International edition
4. Boyd, R.F. (1998). *General Microbiology*, 2nd Edition., Times Mirror, Mosby College Publishing, St Louis.
5. Salle. A.J (1992). *Fundamental Principles of Bacteriology*. 7th Edition., McGraw Hill Inc. New York.

**Reference Books**

1. *General Microbiology: RY Stanier, Adelberg EA and J LIngraham, MacMillan PressInc*
2. *Introduction to Microbiology: Ingraham JL and Ingraham CA Thomson Brooks/ Cole*
3. *Principles of microbiology: RM Atlas WmC brown Publishers*
4. *Brock’s biology of Microorganisms: Madigan MT and Martinko JM Pearson Education Inc*

**Website and e-learning source**

1. <https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-to-microbiology/a-brief-history-of-microbiology>
2. <https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp>
3. <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#>
4. <https://bio.libretexts.org/@go/page/9188>
5. <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-nutrition/>

**Course Learning Outcomes (for Mapping with POs and PSOs)**

On completion of the course the students should be able to

Cos	CO Description	Cognitive Level
CO1	Study the historical events that led to the discoveries and inventions.	K1,K2.K3
CO2	Gain Knowledge of detailed habitat of microbes. Study the prokaryotic and eukaryotic world.	K1,K2,K3,K4
CO3	Understand the impacts of microorganism in environment	K1,K2.K3,K4
CO4	Learn about pure culture techniques	K1,K2.K3
CO5	Explain the principles and working mechanism of different microscopes/Microscope, their function and scope of application	K1,K2.K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	-	-	2	-	-	-	2	3	2	3
CO2	3	2	1	-	-	2	-	-	-	2	3	2	2
CO3	3	3	2	2	1	1	-	-	1	3	3	2	3
CO4	3	2	3	3	2	2	-	-	-	2	3	3	3
CO5	3	2	2	2	2	2	1	-	-	2	3	3	2