



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. AND 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
SEMESTER - I	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	Practical I 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
				Semester Total	30	23			
SEMESTER - II	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	Practical II -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
				Semester Total	30	23			

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	Practical III -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
					Semester Total	30	24		
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
					Semester Total	30	23		

Semester	Part	Category	Course Code	Course Title	Ins.Hrs / Week	Credit	MaximumMarks		
							Internal	External	Total
SEMESTER - V									
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
				Semester Total	30	26			
SEMESTER - VI									
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
					Semester Total	30	21		

Consolidated Semester wise and Component wise Credit distribution

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

*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		
Internal Evaluation	Continuous Internal Assessment Test	25 Marks
	Assignments	
	Seminars	
	Attendance & Class Participation	
External Evaluation	End semester Examination	75Marks
	Total	100 Marks
Methods of Assessment		
Recall (K1)	Simple definitions ,MCQ, Recall Steps Concepts Definitions	
Understand /Compared (K2)	MCQ, True / False, Short Essays , Concept Explanation ,Short summary or Overview	
Application (K3)	Suggest Idea / Concepts With Examples , Suggest Formulate ,Solve Problems, Observe , Explain	
Analysis (K4)	Problem –Solving Questions, Finish a Procedure in many steps, differentiate between Various Ideas, and map Knowledge.	
Evaluate (K5)	Longer Essay / Evaluation Essay Critique Or Justify with pros & Cons	
Create (K6)	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)			
Section A	Very short answer questions	10X 2=20	10 questions – 2 from each unit
Section B	Short answer questions of either / or type (like 1a (or) 1b)	5X5=25	5 questions – 1 from each unit
Section C	Essay-type questions / Problem (Answer any 3 out of 5)	3X10=30	5 questions – 1 from each unit

Question Paper Pattern Practical

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

COURSE DESCRIPTORS

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

UNIT-IV	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
UNIT-V	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. 7thEdition.,McGraw –Hill, New York.*
2. Willey J., Sherwood L., and Woolverton C. J., (2017). *Prescott’s Microbiology. 10th Edition., McGraw-Hill International edition*
3. Tortora, G.J., Funke, B.R., Case,C.L. (2013). *Microbiology. An Introduction 11thEdition., A La Carte Pearson.*
4. Salle. A.J (1992). *Fundamental Principles of Bacteriology. 7thEdition., McGraw Hill Inc.NewYork.*
5. Boyd, R.F. (1998). *General Microbiology,2ndEdition., Times Mirror, Mosby CollegePublishing, St Louis.*

Reference Books

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

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

UNITS	Contents	COs	Cognitive Levels
UNIT-I	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
UNIT-II	Media preparation: liquid media, solid media, semi-solid media, agar slants, agar deeps, agar plates.	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5
UNIT-III	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

UNIT-IV	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
UNIT-V	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 (1st 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, 2nd Edition, Wm.C.Brown publishers.*
2. Amita J, Jyotsna A and Vimala V (2018). *Microbiology Practical Manual. (1st Edition). Elsevier India*
3. Talib VH (2019). *Handbook Medical Laboratory Technology. (2nd Edition). CBS*
4. Wheelis M, (2010). *Principles of Modern Microbiology, 1st Edition. Jones and Bartlett Publication.*
5. Lim D. (1998). *Microbiology, 2nd 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
- 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

Title of the Course	Basic and Clinical Biochemistry	Hours/Week	04
Course Code	AUEMB13	Credits	03
Category	Elective Generic / Discipline Specific Elective-I	Year & Semester	I & I
Prerequisites	Biology	Regulation	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.*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	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
UNIT-II	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
UNIT-III	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

UNIT-IV	Disorders of Metabolism: Disorders of amino acid metabolism: alkaptonuria, phenylketonuria, phenylalaninemia, homocystineuria, tyrosinemia, aminoacidurias.	CO2 CO3 CO4	K1 K2 K3
UNIT-V	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 amino acid 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

Title of the Course	Social and Preventive Medicine	Hours/Week	02
Course Code	AUSMB14	Credits	02
Category	Skill Enhancement Course I	Year & Semester	I & I
Prerequisites	Biology	Regulation	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	Introduction to social medicine: 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	Health management: 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	Health care and services: 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

UNIT-IV	<p>Preventive medicine: 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
UNIT-V	<p>Prevention through alternate medicine: 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, 26th edition.* BanarsidasBhanot publishers.
2. Mahajan & Gupta (2013). *Text book of preventive and social medicine, 4th 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. 12th 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
- 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

Title of the Course	Introduction to Microbial World	Hours/Week	02
Course Code	AUFMB15	Credits	02
Category	Foundation Course	Year & Semester	I & I
Prerequisites	Biology	Regulation	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. Types of microorganisms bacteria, Fungi , Virus .Introduction to prokaryotic world, eukaryotic microorganisms, - Actinomycets –Classification Binomial Nomenclature of Microorganism.	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

UNIT-IV	<p>Definition: Pure culture and axenic culture .Preservation of pure culture, culture collection centers. Pour Plate Technique ,Spread Plate Technique, Calculation methods of Colony Counter.</p>	<p>CO1 CO3 CO4</p>	<p>K1 K2 K3 K4</p>
UNIT-V	<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*,2ndEdition., Times Mirror, Mosby College Publishing, St Louis.
5. Salle. A.J (1992). *Fundamental Principles of Bacteriology*. 7thEdition., 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

COURSE DESCRIPTORS

Title of the Course	MICROBIAL PHYSIOLOGY AND METABOLISM	Hours/Week	05
Course Code	AUCMB21	Credits	05
Category	Core-III	Year & Semester	I & II
Prerequisites	BIOLOGY	Regulation	2024

Objectives of the course:

- *Study the basic principles of microbial growth.*
- *Understand the basic concepts of aerobic and anaerobic metabolic pathways.*
- *Analyze the role of individual components in overall cell function.*
- *Provide information on sources of energy and its utilization by microorganisms.*
- *Study the different types of metabolic strategies*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Physiology of microbial growth: Batch – continuous - synchronous cultures; Growth Curve and measurement method (turbidity, biomass, and cell count). Control of microbial growth.	CO1 CO2 CO3 CO4	K1 K2 K3
UNIT-II	Nutrition requirements - Photoautotrophs, Photoorganotrophs, Chemolithotrophs (Ammonia, Nitrite, Sulfur, Hydrogen, Iron oxidizing Bacteria), Chemoorganotrophs. Nutrition transport mechanisms – Passive diffusion and Active transport. Factors affecting microbial growth.	CO1 CO2 CO3	K1 K2 K3
UNIT-III	An overview of Metabolism - Embden Meyerhof Pathway, EntnerDoudoroff Pathway, Pentose Phosphate Pathway, Tricarboxylic Acid Cycle. Electron Transport Chain and Oxidative Phosphorylation. ATP synthesis. Fermentation-Homolactic Fermentation, Heterolactic Fermentation.	CO3 CO4 CO5	K1 K2 K3

UNIT-IV	Photosynthesis - An Overview of chloroplast structure. Photosynthetic Pigments, Light Reaction-Cyclic and non-cyclic Photophosphorylation. Dark Reaction - Calvin Cycle.	CO2 CO3 CO4 CO5	K1 K2 K3 K4
UNIT-V	Bacterial reproduction - Binary fission, Budding, Reproduction through conidia, cyst formation, endospore formation. Fungi asexual and sexual reproduction, Microalgae reproduction.	CO1 CO2 CO3 CO5	K1 K2 K3

Recommended Text Books

- 1 Schlegel, H.G. (1993). *General Microbiology*, 7th Edition, Press syndicate of the University of Cambridge.
- 2 Rajapandian K. (2010). *Microbial Physiology*, Chennai: PBS Book Enterprises India.
- 3 Meena Kumari. S. *Microbial Physiology*, Chennai 1st Edition MJP Publishers 2006.
- 4 Dubey R.C. and Maheswari, S. (2003). *A textbook of Microbiology*, New Delhi: S. Chand & Co.
- 5 S. Ram Reddy, S.M. Reddy (2008). *Microbial Physiology*. Anmol Publications Pvt Ltd.

Reference Books

1. Robert K. Poole (2004). *Advances in Microbial Physiology*, Elsevier Academic Press, New York, Volume 49.
2. Kim B.H., Gadd G.M. (2008). *Bacterial Physiology and Metabolism*. Cambridge University Press, Cambridge. 5
3. Daniel R. Caldwell. (1995). *Microbial Physiology & Metabolism* Wm.C. Brown Communications, Inc. USA.
4. Moat, A.G and J.W Foaster (1995). *Microbial Physiology*, 3rd edition. Wiley – LISS, A John Wiley & Sons. Inc. Publications.
5. Bhanu Shrivastava. (2011). *Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism*. Lambert academic Publication.

Website and e-learning source

- 1 <https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents>
- 2 <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition>
- 3 https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
- 4 http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf
- 5 <https://www.frontiersin.org/microbial-physiology-and-metabolism>

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	Describe microorganisms based on nutrition.	K1,K2,K3
CO2	Know the concept of microbial growth and identify the factors affecting bacterial growth.	K1,K2,K3
CO3	Explain the overview of the microbial metabolism.	K1,K2,K3
CO4	Describe view of Photosynthesis, Photophosphorylation and Calvin cycle.	K1,K2,K3,K4
CO5	Elaborate on the process of microbial reproduction .Bacteria, Fungi and Microalgae.	K1,K2,K3,K4

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

COURSE DESCRIPTORS

Title of the Course	MICROBIAL PHYSIOLOGY AND METABOLISM	Hours/Week	05
Course Code	AUCPMB22	Credits	05
Category	Core Course IV- Practical II	Year & Semester	I & II
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- *Understand the principles of motility test.*
- *Understand the basic concepts of staining methods.*
- *Learn the bacterial count using different methods and anaerobic culture.*
- *Study the morphological demonstration of microorganisms and identification.*
- *Study the biochemical identification of the bacteria.*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Motility demonstration: hanging drop, wet mount preparation, semi-solid agar. Staining techniques: Smear preparation, Capsular, and Acid-fast staining	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5
UNIT-II	Direct counts – Direct cell count (Petroff- Hausser counting chamber), Turbidometry. Viable count - pour plate, spread plate.	CO1 CO2 CO4 CO3 CO5	K1 K2 K3 K4 K5

UNIT-III	Anaerobic culture methods – Candle jar method. Antibiotic sensitivity testing: Disc diffusion test.	CO1 CO2 CO4 CO5	K1 K2 K3 K4 K5 K6
UNIT-IV	Morphological variations in algae, fungi and protozoa. Micrometry.	CO1 CO2 CO3 CO4	K1 K2 K3 K4 K5
UNIT-V	Methods of bacterial identification- morphological, physiological, and biochemical methods - IMViC test, H ₂ S, TSI, Oxidase, Catalase, Urease test, and Carbohydrate fermentation test. Maintenance of pure culture, paraffin method, stab culture, maintenance of mold culture	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 .*
- 2 Kannan. N (1996). *Laboratory manual in General Microbiology. Palani Publications.*
- 3 Sundararaj T (2005). *Microbiology Lab Manual (1st edition) publications.*
- 4 Gunasekaran. P (2007). *Laboratory manual in Microbiology. New age international publisher.*
- 5 Elsa Cooper (2018). *Microbial Physiology: A Practical Approach. Callisto Reference publisher.*

Reference Books

1. David White., James Drummond., Clay Fuqua (2012) *Physiology and Biochemistry of Prokaryotes*. 4th Ed. Oxford University Press, New York.
2. Robert K. Poole (2004). *Advances in Microbial Physiology*, Elsevier Academic Press, New York, Volume 49.
3. Kim B.H., Gadd G.M. (2008). *Bacterial Physiology and Metabolism*. Cambridge University Press, Cambridge.
4. Dawes, I.W and Sutherland L.W (1992). *Microbial Physiology (2nd edition)*, Oxford Blackwell Scientific Publications.
5. Moat, A.G and J.W Foaster, (1995). *Microbial Physiology, 3rd edition*. Wiley – LISS, A John Wiley & Sons. Inc. Publications.

Website and e-learning source

- 1 <https://sites.google.com/site/microbialphysiologyoddsem/teaching-contents>
- 2 <https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition>
- 3 https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
- 4 <https://www.studocu.com/microbial-physiology-practicals>
- 5 <https://www.agr.hokudai.ac.jp/microbial-physiology>

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	Describe hanging drop, wet mount preparation, semi-solid agar, Craigie's tube method.	K1,K2.K3,K4
CO2	Demonstrate different kind's microbial counts.	K1,K2,K3,K4,K5
CO3	Explain antibiotic sensitivity testing: Disc diffusion test- quality control with standard strains.	K1,K2.K3,K4,K5
CO4	Describe demonstration variation of the fungi, Protozoa and procedure of Micrometry	K1,K2.K3,K4,K5,
CO5	Elaborate on the bacterial identification- Morphological, physiological, and biochemical methods.	K1,K2.K3,K4

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

COURSE DESCRIPTORS

Title of the Course	BIO INSTRUMENTATION	Hours/Week	04
Course Code	AUEMB23	Credits	03
Category	Elective Generic / Discipline Specific Elective-II	Year & Semester	I & II
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- Understand the analytical instruments and study the basic principles in the field of sciences.
- To gain knowledge about principles of spectroscopy
- Understand the analytical techniques of Chromatography and electrophoresis
- To understand the principle of different types of scans used in medical diagnosis
- To gain information about the principles of radioactivity and its measurements

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Basic instruments: pH meter, Buffer of biological importance, Centrifuge- Preparative, Analytical and Ultra, Laminar Air Flow, Autoclave, Hot Air Oven and Incubator. Biochemical calculations- preparations of Molarity, molality and normality solutions, Buffers- Phosphate, Acetate, TE, TAE- Calculation, PPM, Ammonium sulfate Precipitation.	CO1 CO3 CO4	K1 K2 K3 K4
UNIT-II	Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, Ultraviolet and visible, Infra red and Mass Spectroscopy.	CO1 CO2 CO4 CO5	K1 K2 K3 K4
UNIT-III	Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Starch Gel, AGE, PAGE.	CO2 CO3 CO4 CO5	K1 K2 K3 K4

UNIT-IV	Imaging techniques: Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radioisotopes.	CO1 CO2 CO3 CO4	K1 K2 K3
UNIT-V	Fluorescence and radiation based techniques: Spectrofluorimeter, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.	CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1. Jayaraman J (2011). *Laboratory Manual in Biochemistry, 2nd Edition*. Wiley Eastern Ltd., New Delhi.
2. Ponmurugan. P and Gangathara PB (2012). *Biotechniques. 1st Edition*. MJP publishers.
3. Veerakumari, L (2009). *Bioinstrumentation- 5th Edition* -.MJP publishers.
4. Upadhyay, Upadhyay and Nath (2002). *Biophysical chemistry – Principles and techniques 3rd Edition*. Himalaya publishing home.
5. Chatwal G and Anand (1989). *Instrumental Methods of Chemical Analysis*. S.Himalaya Publishing House, Mumbai.

Reference Books

1. Rodney.F.Boyer (2000). *Modern Experimental Biochemistry, 3rd Edition*. Pearson Publication.
2. Skoog A., West M (2014). *Principles of Instrumental Analysis – 14th Edition* W.B.Saunders Co., Philadelphia.
3. N.Gurumani. (2006). *Research Methodology for biological sciences- 1st Edition* – MJP Publishers.
4. Wilson K, and Walker J (2010). *Principles and Techniques of Biochemistry and Molecular Biology. 7th Edition*. Cambridge University Press.
5. Webster, J.G. (2004). *Bioinstrumentation- 4th Edition* - John Wiley & Sons (Asia) Pvt.Ltd, Singapore

Website and e-learning source

1. <http://www.biologydiscussion.com/biochemistry/centrifugation/centrifugeintroduction-types-uses-and-other-details-with-diagram/12489>
2. <https://www.watelectrical.com/biosensors-types-its-working-andapplications/>
3. <http://www.wikiscales.com/articles/electronic-analytical-balance/> Page 24 of 75
4. <https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html>
5. <http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction>

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	Gain knowledge about the basics of instrumentation.	K1,K2.K3,K4
CO2	Exemplify the structure of atoms and molecules by using the principles of spectroscopy.	K1,K2,K3,K4
CO3	Evaluate by separating and purifying the components	K1,K2.K3,K4
CO4	Understand the need and applications of imaging techniques.	K1,K2.K3
CO5	Categorize the working principle and applications of fluorescence and radiation.	K1,K2.K3,K4

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

COURSE DESCRIPTORS

Title of the Course	Nutrition & Health Hygiene	Hours/Week	02
Course Code	AUSMB24	Credits	02
Category	Skill Enhancement Course II (NME)	Year & Semester	I & II
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- *Learn about nutrition and their importance*
- *Make student understand the nutritional facts for a better life.*
- *Learn information to optimize our diet*
- *Impart knowledge on different health care programs taken up by India*
- *Learn knowledge on different health indicators and types of hygiene methods*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Nutrition – definition, importance, Good nutrition, and mal nutrition; Balanced Diet: Basics of Meal Planning. Carbohydrates, Lipids, Proteins and Vitamins –functions, dietary sources, effects of deficiency. Macro and micro minerals –functions, effects of deficiency; food sources of Calcium, Potassium, and Sodium; food sources of Iron, Iodine, and Zinc. Importance of water– functions, sources, requirements and effects of deficiency	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-II	Nutrition for Life Cycle: Balanced diet - Normal, Pregnant, lactating women, Infancy, young children Adolescents, Adults, and the Elderly; Diet Chart; Nutritive value of Indian foods.	CO2 CO3 CO4	K1 K2 K3

UNIT-III	Improper diets: Definition, Identification, Signs and Symptoms - malnutrition, under-nutrition, over-nutrition, Protein Energy Malnutrition, obesity; Nutritional Disease and Disorder - hypertension, diabetes, anemia.	CO2 CO3 CO4	K1 K2 K3 K4
UNIT-IV	Health - Determinants of health, Key Health Indicators, Environment health & Public health; Health-Education: Principles and Strategies. Health Policy & Health Organizations: Health Indicators and National Health Policy of Govt. of India.	CO2 CO3 CO4	K1 K2 K3 K4
UNIT-V	Hygiene – Definition; Personal, Community, Medical and Culinary hygiene; WASH (Water, Sanitation and Hygiene) programme. Rural Community Health: Village health sanitation & Nutritional committee. Community & Personal Hygiene: Environmental Sanitation and Sanitation in Public places.	CO4 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1. Bamji, M.S., K. Krishnaswamy & G.N.V. Brahmam (2009) *Textbook of Human Nutrition* (3rd edition) Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2. Swaminathan (1995) *Food & Nutrition* (Vol I, Second Edition) The Bangalore Printing & Publishing Co Ltd., Bangalore
- 3 SK. Haldar (2022). *Occupational Health and Hygiene in Industry*. CBS Publishers.
- 4 Acharya, Sankar Kr, Rama Das, Minati Sen (2021). *Health Hygiene and Nutrition Perception and Practices*. Satish Serial Publishing House
- 5 Dass (2021). *Public Health and Hygiene*, Notion Press

Reference Books

- 1 VijayaKhader (2000) *Food, nutrition & health*, Kalyan Publishers, New Delhi
- 2 Srilakshmi, B., (2010) *Food Science, (5th Edition)* New Age International Ltd., New Delhi
- 3 Arvind Kumar Goel (2005). *A College Textbook of Health & Hygiene*, ABD Publishers
- 4 Sharma D. (2015). *Textbook on Food Science and Human Nutrition*. Daya Publishing House.
- 5 Revilla M. K. F., Titchenal A. and Draper J. (2020). *Human Nutrition*. University of Hawaii, Mānoa.

Website and e-learning source

1. <https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=969&lid=49>
- 2: <https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=970&lid=137>
- 3 <https://nhm.gov.in/index1.php?lang=1&level=1&sublinkid=149&lid=225>
- 4 - <https://www.who.int/hia/about/faq/en/>
- 5 <https://www.nhp.gov.in/healthylivingViewall>

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	Learn the importance of nutrition for a healthy life	K1,K2.K3, K4
CO2	Study the nutrition for life cycle	K1,K2,K3
CO3	Know the health care programmes of India	K1,K2.K3,K4
CO4	Learn the importance of community and personal health & hygiene measures	K1,K2.K3,K4
CO5	Create awareness on community health and hygiene	K1,K2.K3

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

COURSE DESCRIPTORS

Title of the Course	SERICULTURE	Hours/Week	02
Course Code	AUSMB25	Credits	02
Category	Skill Enhancement Course III	Year & Semester	I & II
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- *Acquire knowledge on the concepts of origin, growth and study of Sericulture as science and scientific approach of mulberry plant.*
- *Describe the morphology and physiology of silkworm.*
- *Discuss effective management of silkworm diseases.*
- *Demonstrate field skills in mulberry cultivation and silkworm rearing with an emphasis on technological aspects.*
- *Demonstrate entrepreneurship abilities, innovative thinking, planning, and setting up small-scale enterprises.*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	General introduction to Sericulture, its distribution in India. Botanical distribution and taxonomical characters of mulberry varieties and species. Biology of Mulberry plant and Mulberry crop cultivation and protection.	CO1 CO2 CO3 CO4	K1 K2 K3 K4
UNIT-II	Silkworm- biology-morphology of silkworm. Life cycle of silkworm- egg, larva, pupa, and moth.	CO1 CO2 CO3	K1 K2 K3 K4

UNIT-III	Silkworm pathology: Introduction to Parasitism, Commensalism, Symbiosis and Parasite relationship - Mulberry Silkworm Diseases: Introduction, types, Pebrine, Grasserie, Muscardine, Flacherie, Symptoms and Pathogens, Mode of Infection, Prevention and Control -Non – mulberry silkworm diseases: Pebrine, Bacterial and viral diseases. Brief Account of Pests and Predators of Silkworms, Nature of damage and control measures.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-IV	Rearing of silkworm. Cocoon assessment and processing technologies. Value added products of mulberry and silkworms.	CO1 CO3 CO4	K1 K2 K3 K4
UNIT-V	Entrepreneurship and rural development in sericulture: Planning for EDP, Project formulation, Marketing, Insectary facilities and equipments: Location, building specification, air conditioning and environmental control, furnishings and equipment, sanitation and equipment, subsidiary facilities.	CO1 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1. Ganga, G. and SulochanaChetty (2010). *Introduction to Sericulture*, J., Oxford and IBH Pub. Co. Pvt. Ltd., New Delhi.
2. Dr. R. K. Rajan & Dr. M. T. Himantharaj (2005). *Silkworm Rearing Technology*, Central Silk Board, Bangalore.
3. Dandin S B, Jayant Jayaswal and Giridhar K (2010). *Handbook of Sericulture technologies*, Central Silk Board, Bangalore.
4. M. C. Devaiah, K. C. Narayanaswamy and V. G. Maribashetty (2010). *Advances in Mulberry Sericulture*, CVG Publications, Bangalore
5. T.V. Sathe and Jadhav. A.D. (2021). *Sericulture and Pest Management*, Daya Publishing House.

Reference Books

1. S. Morohoshi (2001). *Development Physiology of Silkworms 2nd Edition*, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi
2. Hamamura, Y (2001). *Silkworm rearing on Artificial Diet*. Oxford & IBH publishing Co., Pvt. Ltd. New Delhi.
3. M. Johnson, M. Kesary (2019). *Sericulture, 5th. Edition*. Saras Publications.
4. Manisha Bhattacharyya (2019). *Economics of Sericulture*, Rajesh Publications.
5. Muzafar Ahmad Bhat, Suraksha Chanotra, Zafar Iqbal Buhroo, Abdul Aziz and Mohd. Azam (2020). *A Textbook on Entrepreneurship Development Programme in Sericulture*, IP Innovative Publication.

Website and e-learning source

- 1 <https://egyankosh.ac.in> › bitstream
- 2 <https://archive.org> › details › Sericulture Handbook
- 3 <https://www.academic.oup.com>
- 4 <https://www.sericulture.karnataka.gov.in>
- 5 <https://www.silks.csb.gov.in>

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	Discuss the overall aspects of Sericulture and the biology and varieties of mulberry plant.	K1,K2,K3,K4
CO2	Familiarize with the lifecycle of silk worm.	K1,K2,K3,K4
CO3	Explain common diseases of silkworm encountered during rearing, sources of infection, disease symptoms	K1,K2.K3,K4
CO4	Attain thorough knowledge about the cultivation of mulberry by Various process.	K1,K2.K3,K4
CO5	.Analyze the importance of sericulture in entrepreneurship development and emerge as potential entrepreneur.	K1,K2.K3,K4,K5

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