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.

VISIONOF THE COLLEGE

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

MISSIONOF THE COLLEGE

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

QUALITY POLICYOF 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 peace 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

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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	**S**ocial 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	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	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 (KI)	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, Archaebacteria 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. 7th Edition.,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. AmbikaShanmugam's (2016). Fundamentals of Biochemistry for Medical Students, 8th Edition. Wolters Kluwer India Pvt Ltd.

4. Vasudevan. D.M.Sreekumari.S, KannanVaidyanathan (2019). Textbook Of Biochemistry For Medical Students. Kindle edition, Jaypee Brothers Medical Publishers

5. Jeremy M. Berg,LubertStryer, John L. Tymoczko, Gregory J. Gatto (2015).Biochemistry, 8th edition. WH Freeman publisher.

Reference Books

1.AmitKessel&Nir Ben-Tal (2018). Introduction to Proteins: structure, function and Motion. 2ndEdition, Chapman and Hall.

2.David L. Nelson and Michael M. Cox (2017).Lehninger Principles of Biochemistry,7thEdition W.H. Freeman and Co., NY.

3. LupertStyrer, Jeremy M. Berg, John L. Tymaczko, Gatto Jr., Gregory J (2019).Biochemistry. 9thEdition ,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 AswathyC (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

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	**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.	CO2 CO3 CO4	K1 K2 K3 K4
UNIT-V	**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.	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, 4thedition. Jaypeebrothers 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 Biostatics. 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 BehavioralMedicine.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	Definition: Pure culture and axenic culture .Preservation of pure culture, culture collection centers. **Pour Plate Technique ,Spread Plate Technique, Calculation methods of Colony Counter.**	CO1 CO3 CO4	K1 K2 K3 K4
UNIT-V	Techniques used to study microorganisms 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. 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	CO1 CO5	K1 K2 K3

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-tomicrobiology/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/microbialnutrition/

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 Schlegal, H.G. (1993). General Microbiology.,7th Edition, Press syndicate of the University of Cambridge.

2 RajapandianK.(2010). Microbial Physiology, Chennai: PBS Book Enterprises India.

3 MeenaKumari. 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 .BhanuShrivastava. (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/microbial physiologyoddsem/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, H2S, 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. DavidWhite., 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-Phospahte ,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.1stEdition. MJP publishers.

3 Veerakumari, L (2009).Bioinstrumentation- 5 thEdition -.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.

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Reference Books

1. Rodney.F.Boyer (2000). Modern Experimental Biochemistry, 3rd Edition. Pearson Publication.

2.SkoogA.,WestM (2014). Principles of Instrumental Analysis – 14th Edition W.B.SaundersCo.,Philadephia.

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.7thEdition. 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 fora 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, MinatiSen (2021). Health Hygiene and Nutrition Perception and Practices.Satish Serial Publishing House

5 Dass (2021).Public Health and Hygiene, Notion Press

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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.DayaPublishing 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	SERICULT URE	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, JayantJayaswal 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.SatheandJadhav.A.D.(2021). Sericulture and Pest Management, Daya Publishing House.

Reference Books *1. S. Morohoshi (2001). Development Physiology of Silkworms 2ndEdition, Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi* *2. Hamamura, Y (2001). Silkworm rearing on Artificial Diet. Oxford & IBH publishing Co., Pvt. Ltd. NewDelhi.* *3 .M.Johnson, M.Kesary (2019).Sericulture, 5th.Edition.Saras Publications.* *4. Manisha Bhattacharyya (2019).Economics of Sericulture, Rajesh Publications.* *5. Muzafar Ahmad Bhat, SurakshaChanotra, 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 › SericultureHandbook* *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

COURSE DESCRIPTORS

Title of the Course	**MOLECULAR BIOLOGY & MICROBIAL GENETICS**	**Hours/Week**	05
Course Code	**AUCMB31**	**Credits**	05
Category	Core - V	**Year & Semester**	II & III
Prerequisites	BIOLOGY	**Regulation**	2024

Objectives of the course:

- Provide knowledge on structure and replication of DNA.
- Illustrate the significance and functions of RNA in protein synthesis.
- Explain the cause and types of DNA mutation and DNA repair mechanisms.
- Outline the role of plasmids and phages in genetics.
- Examine mechanisms of gene transfer and recombination.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Structure & Function of gene -DNA Structure - Salient features of double helix, forms of DNA. Denaturation and renaturation. DNA topology – Supercoiling, linking number, topoisomerases. DNA organization in prokaryotes, viruses, eukaryotes and Genetic code. Replication of DNA in prokaryotes and eukaryotes - Bidirectional and unidirectional replication, semi-conservative and semi-discontinuous replication. Mechanism of DNA replication – enzymes involved–DNA polymerases, DNA ligase, primase. DNA replication modes-rolling circle, D-loopmodes.	CO1 CO3 CO5	K1 K2 K3
UNIT-II	Transcription in Prokaryotes. Concept of transcription. RNA Polymerases - prokaryotic and eukaryotic. General transcription factors in eukaryotes. Distinction between transcriptionprocesses in prokaryotes versus eukaryotes. Translation in prokaryotes and eukaryotes-Translation almachinery-ribosome structure in prokaryotes and eukaryotes, tRNA structure and processing. Inhibitors of protein synthesis in prokaryotesandeukaryotes.Overviewofregulationofgeneexpression-*lac,trp* and *ara* operons as examples. Regulation of gene expression by DNA methylation	CO2 CO3	K1 K2 K3

UNIT-III	Mutation-Definition and types-base substitutions,frame shifts, deletions, insertions, duplications, inversions. Silent, conditional, and lethal mutations. Physical and chemical mutagens. Reversion and suppression. Uses of mutations. Repair Mechanisms - Photoreactivation, Nucleotide Repair, Base Excision Repair,Methyl Directed Mismatch Repair and SOS Repair	CO5	K1 K2 K3
UNIT-IV	Plasmids- Types of plasmids – R Plasmids, F plasmids, colicinogenic plasmids, metal resistance plasmids, Ti plasmid, linear plasmids, yeast 2µ plasmid. Bacteriophage-T4, Virulent Phage – Structure and lifecycle. Lambda phage-Structure, Lytic and Lysogenic cycle.Applications of Phages in Microbial Genetics. Plasmid replication and partitioning, host range, plasmid incompatibility, plasmid amplification, regulation of plasmid copy number, curing of plasmids.	CO4 CO5	K1 K2 K3 K4
UNIT-V	Gene Transfer Mechanisms- Conjugation and its uses. Transduction - Generalized and Specialized, Transformation - Natural Competence and Transformation. Transposition and Types of Transposition reactions. Mechanism of transposition: Replicative and non- replicative transposition. Transposable elements - Prokaryotic transposable elements – insertion sequences, composite, and non-composite transposons. Uses of transposons	CO1 CO3 CO5	K1 K2 K3

Recommended Text Books

1. Malacinski G.M. (2008). Freifelder's Essentials of Molecular Biology. 4th Edition. Narosa Publishing House, New Delhi.

2. Gardner E. J. Simmons M. J. and SnustedD.P.(2006). Principles of Genetics. 8th Edition. Wiley India Pvt. Ltd.

3. Trun N. and Trempy J. (2009). Fundamental Bacterial Genetics. 1st Edition. Blackwell Science Ltd.

4. Brown T. A. (2016). Gene Cloning and DNA Analysis- An Introduction. (7th Edition). John Wiley and Sons, Ltd.

5. Dale J. W., Schantz M.V. and Plant N. (2012). From Gene to Genomes – Concepts and Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.

Reference Books

1. Glick B. R. and Patten C.L. (2018). Molecular Biotechnology – Principles andApplications of Recombinant DNA. 5th Edition. ASM Press.

2. Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson NewInternational edn.

3. Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7th Edition,W.H. Freeman.

4. Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Genetics ofBacteria, 4th Edition, ASM Press Washington-D.C. ASM Press.

5. Primrose S.B. and Twyman R. M. (2006). Principles of Gene Manipulation andGenomics. (7th Edition). Blackwell Publishing

Website and e-learning source

1. [PDF] Lehninger Principles of Biochemistry (8th Edition) By David L. Nelson and Michael M. Cox Book Free Download - StudyMaterialz.in

2. https://microbenotes.com/gene-cloning-requirements-principle-steps-applications/

3. https://courses.lumenlearning.com/boundless-biology/chapter/dna-replication/54

4. Molecular Biology Notes - Microbe Notes

5. Molecular Biology Lecture Notes & Study Materials | Easy Biology Class

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	Analyze the significance of DNA and elucidate the replication mechanism.	K1,K2.K3,K4
CO2	Illustrate the types of RNA and protein synthesis machinery.	K1,K2,K3
CO3	Infer the causes and types of DNA mutation and summarize the DNA repair mechanisms.	K1,K2.K3
CO4	Evaluate the importance of plasmids and phages in genetics.	K1,K2.K3,K4
CO5	Analyze gene transfer and recombination methods.	K1,K2.K3,K4

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

COURSE DESCRIPTORS

Title of the Course	PRACTICAL III -MOLECULAR BIOLOGY AND MICROBIAL GENETICS	Hours/Week	05
Course Code	AUCPMB32	Credits	05
Category	Core VI	Year & Semester	II & III
Prerequisites	Biology	Regulation	2024

- **Objectives of the course:**
- Provide knowledge on structure and replication of DNA.
- Elucidate the methods of Genomic and Plasmid DNA isolation.
- Explain methods of protein separation.
- Explain artificial transformation method.
- Outline the role of phages in genetics.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Isolation of Genomic and Plasmid DNA from *E.coli* and Analysis by Agarose gelelectrophoresis	CO1 CO2	K1 K2 K3 K4 K5
UNIT-II	Estimation of DNA using colorimeter (diphenylamine reagent), UV spectrophotometer (A260 measurement).Estimation of RNA (Orcinol Method)	CO1 CO2 CO4	K1 K2 K3 K4 K5
UNIT-III	Resolution and visualization of proteins by polyacrylamidegel electrophoresis (SDS-PAGE) – Demonstration.UV induced auxotrophic mutant production and isolation of Mutants by replicaplating technique–Demonstration	CO1 CO2 CO3	K1 K2 K3 K4 K5 K6

UNIT-IV	Isolation of antibiotic resistant mutants by gradient plate method.- Demonstration	CO3 CO4	K1 K2 K3 K4 K5
UNIT-V	Screening and isolation of phages from sewage .Estimate RNA .	CO2 CO5	K1 K2 K3 K4 K5 K6

Recommended Text Books

1. Crichton. M. (2014). Essentials of Biotechnology. Scientific International PvtLtd.New Delhi.

2. Sambrook J. and Russell D.W. (2001). Molecular Cloning - A Laboratory Manual –7th Edition. Cold Spring Harbor, N.Y: Cold Spring Harbor Laboratory Press.

3. Dale J. W., Schantz M. V. and Plant N. (2012). From Gene to Genomes – Conceptsand Applications of DNA Technology. (3rd Edition). John Wileys and Sons Ltd.

4. Gunasekaran P. (2007). Laboratory Manual in Microbiology. New Age International.

5. James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual. (5th Edition). The Benjamin publishing company. New York.

Reference Books

1 Glick B. R. and Patten C.L. Molecular Biotechnology – Principles and Application of Recombinant DNA. 5th Edition. ASM Press. 2018.

2 Russell P.J. (2010). iGenetics - A Molecular Approach, 3rd Edition., Pearson New International edn.

3 Nelson, D.L. and Cox, M.M. Lehninger(2017). Principles of Biochemistry. 7th Edition, W.H. Freeman.

4 Synder L., Peters J. E., Henkin T.M. and Champness W. (2013). Molecular Geneticsof Bacteria, 4th edition, ASM Press Washington-D.C. ASM Press.

5 Brown T.A. (2016). Gene Cloning and DNA Analysis. (7th Edition). John Wiley andJones, Ltd

Website and e-learning source

1 https://www.molbiotools.com/usefullinks.html

2 (PDF) Molecular Biology Laboratory manual (researchgate.net)

3 https://www.molbiotools.com/usefullinks.html

4 https://geneticgenie.org3.

5 https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5

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	Illustrate different types of DNA and RNA.	K1,K2.K3,K4
CO2	Utilize hands-on training in isolation of genomic and plasmid DNA.	K1,K2,K3,K4,K5
CO3	Analyze importance of experimental microbial genetics	K1,K2.K3,K4,K5
CO4	Apply the knowledge of molecular techniques in various fields.	K1,K2.K3,K4,K5,
CO5	Investigate the significance of Phages.	K1,K2.K3,K4

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

COURSE DESCRIPTORS

Title of the Course	CLINICAL LABORATORY TECHNOLOGY	Hours/Week	03
Course Code	AUEMB33	Credits	03
Category	Elective III	Year & Semester	II & III
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- Demonstrate ethical and professional conduct with patients, laboratory personnel, health care professionals, and the public.
- Explain how accurate and reliable information might be obtained about proper procurement, storage, and handling of laboratory specimens.
- Develop a sound scientific knowledge foundation that prepares them to interpret, analyzeand evaluate scientific knowledge in clinical practice.
- Perform a full range of laboratory tests with accuracy and precision.
- Establish quality assurance principles and practices to ensure the accuracy and reliability ofLaboratory information.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	**Introduction to Clinical Laboratory Science**: Basic laboratory principles - Code of conduct for medical laboratory personnel - Organization of clinical laboratory and role of medical laboratory technician - Safety measures. Assessment of a patient and briefhistoryofcollection.MaintenanceofHygiene&InfectionControl Practices.	CO1 CO3 CO4	K1 K2 K3 K4
UNIT-II	**Specimen collection and processing**-Blood, urine, stool, sputum CSF, amniotic fluid and bile. Separation of serum and plasma, Handling of specimens for testing, preservation of specimens transport of specimens and factors affecting the clinical results.	CO1 CO2	K1 K2 K3 K4

UNIT-III	**Introduction to histopathology**-Methods of examination of tissues and cells, Fixation of tissues: Classification and properties offixatives. Tissue processing -Collection of specimens, Labeling and fixation,Dehydration,Clearing,Impregnation,Embedding-Paraffin Block making, SectionCutting.	CO2 CO3	K1 K2 K3 K4
UNIT-IV	**Introduction to Haematology**- Laboratory methods used in the investigation of coagulation disorders - coagulation tests , Routine coagulation tests, Laboratory diagnosis of bleeding disorders. Estimation of fibrinogen, Assay of coagulation factors..	CO3 CO4	K1 K2 K3
UNIT-V	**Quality Standards in Health Laboratories** – Development and implementation of standards, Accreditation Boards –NABL, ISO, CAP,COLA, Performing quality assessment-pre-analytical,analytical,andpost-analyticalphasesoftesting.	CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1. Mukharji,K.L. (2000).Medical Laboratory Techniques, Vol - I, II & III, 5th Edition. Tata McGrawHill, Delhi.

2. Ochei,A., Kolhatkar.A. (2000).Medical Laboratory Science: Theory and Practice, McGraw Hill Education.

3 Ramnik Sood (2015).Concise Book of Medical Laboratory Technology:Methods and Interpretation, 2ndEdition, Jaypee Brothers Medical Publishers, NewDelhi.

4. S. Ramakrishnan, KN Sulochana(2012). Manual of Medical Laboratory Techniques, Jaypee Brothers Medical Publishers Pvt. Ltd

5. Talib V.H. (2019).Handbook Medical Laboratory Technology, 2ndEdition, Directorate of health services, Government of India.

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Reference Books

1 Rutherford, B.H. Gradwohl , A.C. Sonnenwirth L. Jarett. Gradwohls. (2000). Clinical Laboratory Methods and Diagnosis, Vol-I, 8th edition, Mosby.

2 Baker, F.J., Silverton, R.E., and Pallister,.J. (1998). An Introduction to Medical Laboratory Technology, 7thEdition, CBS Publishers and Distributors Pvt. Ltd.

3 Godkar (2021).Textbook of Medical Laboratory Technology, 3rdEdition,Bhalani Publishing House.

4 M.N.Chatterjee and RanaShinde.(2008). Textbook of Medical Biochemistry, 7thEdition,Jaypee Brothers Medical Publishers Pvt. Limited.

5 James G Cappucino. and Natalie Sherman. (2016). Microbiology – A laboratory manual.(5th Edition).The Benjamin publishing company. New York.

Website and e-learning source

1 https://www.jaypeedigital.com › book

2 https://www.pdfdrive.com › wintrobes-clinical-hematology

3 https://currentprotocols.onlinelibrary.wiley.com/doi/pdf/10.1002/cpet.5

4 https://vlab.amrita.edu/index.php?sub=3&brch=272

5 https://nptel.ac.in/courses/102105087

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	Define basic laboratory principles, safety measures, and the code of conduct for medical laboratory personnel.	K1,K2.K3,K4
CO2	Explain the role of a medical laboratory technician, the structure of a clinical laboratory, and the importance of hygiene and infection control practices.	K1,K2,K3,K4
CO3	Demonstrate correct techniques for specimen collection, processing, and handling (e.g., blood, urine, CSF), ensuring proper preservation and transport to maintain accurate clinical results.	K1,K2.K3,K4
CO4	Differentiate between various tissue processing methods, fixatives, and laboratory procedures for histopathology and hematology, including coagulation tests and diagnosis of bleeding disorders	K1,K2.K3
CO5	Assess quality standards in health laboratories, including NABL, ISO, CAP, and COLA accreditation requirements	K1,K2.K3,K4

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
CO1	3	2	2	3	3	3	-	-	-	3	3	3	3
CO2	3	3	3	3	3	3	-	-	-	2	3	3	3
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	**ORGANIC FARMING AND BIOFERTILISER TECHNOLOGY**	**Hours/Week**	01
Course Code	**AUSMB34**	**Credits**	01
Category	**Skill Enhancement Course IV**	**Year & Semester**	II & III
Prerequisites	Biology	**Regulation**	2024

Objectives of the course:

- Impart knowledge about the significance of organic farming and strategies to increase the yield to conserve environment.
- To encourage organic farming in urban areas.
- Comprehensive knowledge about bacterial biofertilizers, its advantages and future perspective.
- Structure and characteristic features of Cyanobacterial and fungal biofertilizer
- Develop the knowledge and skill to produce, analyze the quality of packaging, storage and assess the shelf life and bioefficacy of biofertilizers.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Principle of organic farming: principles of health, fairness, ecological balance, and care.Environmental benefits of organic farming: sustainability- reduces non-renewable energy by decreasing agrochemical need.Biodiversity-crop rotation, inter-cropping.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-II	Organic farming for urban space; Create a Sustainable Organic Garden(Backyard- Square Foot Gardening, Small Space Gardening,MiniFarming)Composting,Vermicomposting	CO1 CO2 CO3 CO4	K1 K2 K3
UNIT-III	Biofertilizers: Introduction, advantages and future perspective. Structure and characteristic features of bacterial biofertilizers- *Azospirillum,Azotobacter,Bacillus,Pseudomonas,Rhizobium*and *Frankia*	CO2 CO3 CO4 CO5	K1 K2 K3 K4

UNIT-IV	Structure and characteristic features of Cyanobacterial biofertilizers-*Anabaena, Spirulina* -Structure and characteristic features of fungal biofertilizers-AM mycorrhiza	CO2 CO3 CO4	K1 K2 K3 K4
UNIT-V	Production of *Rhizobium, Azotobacter, Anabena*; Biofertilizers - Storage, shelf life, quality control and marketing	CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1. A.K. Sharma (2006). Hand book of Organic Farming

2. A.C.Gaur (2017). Hand book of Organic Farming and Biofertilizers

3. N.S. Subbarao (2017). Bio-fertilizers in Agriculture and Forestry (4th Edition) Med tech publisher

4. SubbaRao, N. S. (2002). Soil Microbiology. Soil Microorganisms and Plant Growth. (4th Edition), Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

5. Dubey, R. C. (2008). A Textbook of Biotechnology. S. Chand & Co., New Delhi.

Reference Books

1 Masanobu Fukuoka, Frances Moore Lappe Wendell Berry (2009). The One-StrawRevolution: An Introduction to Natural Farming, 1st edition, YRB Classics.

2 SujitChakrabarty(2018). Organic Home Gardening Made Easy, 1st Edition,

3 Singh and Purohit (2008). Biofertilizer technology. Agrobios, India.

4 Bansal M (2019). Basics of Organic Farming CBS Publisher.

5 Hurst, C.J., Crawford R.L., Garland J.L., Lipson D.A., Mills A.L. and Stetzenbach L.D. (2007). Manual of Environmental Microbiology. (3rd Edition). AmericanSociety for Microbiology.

Website and e-learning source

1. https://agritech.tnau.ac.in/org_farm/orgfarm_introduction.html
2. https://www.fao.org/organicag/oa-faq/oa-faq6/en/
3. https://www.india.gov.in/topics/agriculture/organic-farming
4. https://agriculture.nagaland.gov.in/bio-fertilizer/
5. https://vlab.amrita.edu/index.php?sub=3&brch=272

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	Become an Entrepreneur with wide knowledge about farming and sustainable resources	K1,K2.K3, K4
CO2	Implement organic farming in urban areas with knowledge on compost.	K1,K2,K3
CO3	Gain knowledge about the bacterial biofertilizers and its advantages	K1,K2.K3,K4
CO4	Understand the significance about Cyanobacterial and fungal biofertilizers	K1,K2.K3,K4
CO5	Understand and implement the use of bio fertilizers.	K1,K2.K3

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

COURSE DESCRIPTORS

Title of the Course	AQUACULTURE	Hours/Week	02
Course Code	AUSMB35	Credits	02
Category	Skill Enhancement Course V	Year & Semester	II & III
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- Provide a deeper knowledge in aquaculture systems and methods.
- Explain the significance and functions of design, types and construction of aquaculture ponds.
- Demonstrate the biological characteristics of various aquaculture species.
- Discuss the methods involved in post stocking management.
- Illustrate major cultivatable species for aquaculture

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Aquaculture Systems and Methods - Scope and definition. Traditional, extensive, semi - intensive and intensive culture. Monoculture, polyculture, composite culture, mixed culture, mono-sexculture, cage culture, penculture, raft culture, raceway culture	CO1 CO2	K1 K2 K3 K4
UNIT-II	Aquaculture Engineering-Design and construction of pond, lay-Out and design of aquaculture farm, construction, water intake system, drainage system - aeration and aerators.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-III	Selection of Species - Biological characteristics of aquaculture species; economic and market considerations; seed resources, collection and transportation. Pre-Stocking Management-Sun drying, ploughing / tilling, desilting, liming and fertilization, eradicationofweedfishes.Stocking-Acclimatizationofseedandrelease-speciescombinations-stocking density and ratio.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-IV	Post Stocking Management - Water and soil quality parametersrequired for optimum production, control of aquatic weeds andaquatic insects, algal blooms and microorganisms. Foodconversion ratio (FCR). Growth - Measurement of growth, length- weight relationship..	CO1 CO2 CO3	K1 K2 K3 K4

UNIT-V	Major cultivable species for aquaculture –Culture of Indian Major Carps. Culture of Giant fresh water prawn, *Macrobrachiumrosenbergii*- seed collection formation sources. Hatchery management. Culture of tiger shrimp, *Penaeusmonodon*and *LitopenaeusVannamei*. Culture of pearl oysters. Culture of sea weeds.Methods of Crab culture. Culture of ornamental fishes. Culture of Molluscs.	CO1 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1. Santhanam, R. Velayutham, P. Jegatheesan, G. A (2019).Manual of FreshwaterEcology: An Aspect of Fishery Environment. Daya Publishing House, New Delhi.

2. Stickney, R.R. (2016). Aquaculture: An Introductory Text. 3rd Edition. Centre forAgriculture and Bioscience International Publishing.

3. Ackefors H., Huner J and Konikoff M. (2009). Introduction to the General Principlesof Aquaculture. CRC Press.

4. Mushlisin Z. A. (2012). Aquaculture. In Tech.

5. Akpaniteaku R.C. (2018).Basic Handbook of Fisheries and Aquaculture. AkiNik Publications

Reference Books

1. *Arumugam N. (2014). Aquaculture. Saras Publication.*

2. Pillay T. V. R. and Kutty M.N. (2005). Aquaculture : Principles and Practices2ndEdition. Wiley India Pvt. Ltd.

3. Tripathi S. D., Lakra W.S. and Chadha N.K. (2018). Aquaculture in India. NarendraPublishing House.

4. Rath R.K.(2011). Fresh Water Aquaculture. 3rdEdition. Scientific Publishers.

5. Lucas J. S., Southgate P.C. and Tucker C.S. (2019). Aquaculture: Farming AquaticAnimals and Plants. Wiley Blackwell..

Website and e-learning source

1. Aquaculture: Types, Benefits and Importance (Fish Farming) - Conserve EnergyFuture (conserve-energy-future.com)

2. Fisheries Department - Tamil Nadu (tn.gov.in)

3. Aquaculture - Google Books

44. aquaculture | Definition, Industry, Farming, Benefits, Types, Facts, & Methods |Britannica

5. Fisheries & Aquaculture (investindia.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	Analyze the significance and importance of aquaculture	K1,K2,K3,K4
CO2	Illustrate the types and construction of aquaculture ponds	K1,K2,K3,K4
CO3	Analyze the biological characteristics of species and choose the best species for aquaculture.	K1,K2.K3,K4
CO4	Follow methods involved for optimal growth of aquaculture species.	K1,K2.K3,K4
CO5	Summarize major species suitable for aquaculture in a particularenvironment	K1,K2.K3,K4,K5

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

COURSE DESCRIPTORS

Title of the Course	**ALLIED MICROBIOLOGY I**	**Hours/Week**	03
Course Code	**AUAEMB33**	**Credits**	03
Category	Allied - III	**Year & Semester**	II & III
Prerequisites	Higher Secondary / Chemistry/Biology/Mathematics/Botany/Zoology/ Physics	**Regulation**	2024-2025

Objectives of the course:

- *Learn the History and Evolution of Microbiology.*
- *Describe the structural organization, morphology and reproduction of microbes.*
- *Explain the methods of cultivation of microbes.*
- *Understand the microscopy and staining techniques*
- *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 and eight kingdom. Spontaneous generation – Biogenesis Contributions of Leeuwenhoek, Louis Pasteur, Robert Koch, Elie Metchnikoff and Fleming.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-II	General characteristics of microorganisms -Bacteria, Algae, Fungi, Viruses and Protozoa. Differences between prokaryotic and eukaryotic Microorganisms. Anatomy of prokaryotes - cell wall, cytoplasmic membrane, cilia, flagella capsule, cytoplasmic inclusions, sporulation	CO1 CO2 CO3 CO4	K1 K2 K3 K4

UNIT-III	Bacterial culture media and pure culture techniques. Anaerobic culture techniques	CO1 CO2 CO3 CO4	K1 K2 K3 K4 K5
UNIT-IV	Microscopy – Simple, bright field, dark field, phase contrast, fluorescent, electron microscope – TEM & SEM. Staining methods	CO2 CO3 CO4 CO5	K1 K2 K3 K4
UNIT-V	Sterilization - methods of sterilization and Disinfection. Antimicrobial chemotherapy - tests for sensitivity to antimicrobial agents.	CO1 CO2 CO3 CO5	K1 K2 K3

Recommended Text Books

1. *Pelczar, M. J., Chan, E. C. S., & Noel, R. K. (2007). Microbiology (7th ed.). McGraw–Hill, New York.*

2. *Willey, J., Sherwood, L., & Woolverton, C. J. (2017). Prescott's Microbiology (10th ed.). McGraw-Hill International Edition.*

3. *Salle, A. J. (1992). Fundamental Principles of Bacteriology (7th ed.). McGraw-Hill Inc., New York.*

4. *Boyd, R. F. (1998). General Microbiology (2nd ed.). Times Mirror, Mosby College Publishing, St. Louis.*

Reference Books

1. *Jeffrey C.Pommerville.,Alcamo's FundamentalsofMicrobiology(9th Edition).Jones & Bartlett learning 2010.*

2. *Stanier R.Y,Ingraham J.L.,Wheelis M.L.,and Painter R.R.(2010).GeneralMicrobiology,5th Edition.,Mac Millan Press Ltd*

3. *Stanier R.Y,Ingraham J.L.,Wheelis M.L.,and Painter R.R.(2010).General Microbiology,5th Edition.,Mac Millan Press Ltd*

4. *Nester E.,Anders on D.,RobertsC.E.,and Nester M.(2006).Microbiology-A Human Perspective,5th Edition.,McGraw Hill Publications.*

5. *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://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 and understand the Classification of Microorganisms.	K1,K2.K3,K4
CO2	Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.	K1,K2,K3
CO3	Understand the various microbiological techniques, different 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	.K4,K5
CO5	Understand the concept of asepsis and modes of sterilization and disinfectants.	K4,K5,K6

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

COURSE DESCRIPTORS

Title of the Course	ALLIED MICROBIOLOGY PRACTICAL -II	Hours/Week	03
Course Code	AUAEPMB43	Credits	03
Category	Allied -IV	Year & Semester	II & IV
Prerequisites	Higher Secondary / Chemistry/Biology/Mathematics/Botany/Zoology/ Physics	Regulation	2024-25

Objectives of the course:

- *Acquire knowledge on cleaning of glassware's and sterilization.*
- *Gain knowledge on media preparation and cultural characteristics.*
- *Learn the pure culture technique*
- *Learn the microscopic techniques and staining methods.*
- *Acquire knowledge to isolate the microorganisms from the environment*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Cleaning of glassware's, Microbiological good laboratory practice and safety. Sterilization of glassware's and media.	CO1 CO3 CO4	K1 K2 K3 K4
UNIT-II	Media preparation: liquid and solid media. Antibiotic sensitivity testing–Kirby Bauer method.	CO1 CO2 CO3	K1 K2 K3
UNIT-III	Pure culture techniques: streak plate, Serial dilution – spread plate and pour plate.	CO1 CO2 CO3	K1 K2 K3 K4

UNIT-IV	Staining techniques: Smear preparation, simple staining, and Gram's staining**.** Motility demonstration: Hanging drop technique. Fungal identification by Lactophenol cotton blue staining technique**.**	CO3 CO4 CO5	K1 K3 K4 K5
UNIT-V	Isolation of microorganisms from air, soil and sewage. Testing the quality of milk-MBRT	CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1. James G Cappucino and N.Sherman MB(1996).A lab manual Benjamin Cummins, NewYork 1996

2. Kannan.N(1996).Laboratory manual inGeneral Microbiology.Palani Publications.

3 Sundararaj T(2005).Microbiology LabManual(1st edition)publications.

4. Gunasekaran,P.(1996).Laboratory manual in Microbiology.New Age International Ld.,Publishers, NewDelhi.

5. RC Dubey and DK Maheswari (2002).Practical Microbiology.S.Chand Publishing.

Reference Books

1.Atlas, R. (1997). Principles of Microbiology*, 2nd Edition, W.M.C. Brown Publishers.*

2.Amita, J., Jyotsna, A., and Vimala, V. (2018). Microbiology Practical Manual *(1st Edition). Elsevier India.*

3. Talib, V.H. (2019). Handbook of 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.	K1,K2.K3,K4
CO2	Learn to prepare different media and their quality control.	K1,K2,K3
CO3	Learn streak plate, pour plate and serial dilution, and pigment production of microbes.	K1,K2.K3,K4
CO4	Understand microscopy methods, different staining techniques, and motility test.	K1,K3,K4,K5
CO5	Acquire knowledge to isolate bacteria from the environment.	K1,K3.K4,K5

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

COURSE DESCRIPTORS

Title of the Course	IMMUNOLOGY AND IMMUNOTECHNOLOGY	**Hours/Week**	05
Course Code	**AUCMB41**	**Credits**	05
Category	Core - VII	**Year & Semester**	II & IV
Prerequisites	BIOLOGY	**Regulation**	2024

Objectives of the course:

- To gain knowledge about immune system, organs of immunity and cells involved.
- To distinguish the types of antigens and antibodies; their properties.
- To provide in-depth knowledge on immuno-techniques.
- To discuss the role of MHC system in transplantation; functions of Tumor specific antigens.
- To impart knowledge on immunological disorders.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Organs and Cells in Immune System and Immune Response: Primary lymphoid organs, secondary lymphoid organs, and lymphoid tissues; T – cell and B –cell membrane bound receptors – apoptosis; T - cell processing, presentation and regulation; T –cell subpopulation, properties, functions and T – cell suppression; Physiology of immune response- Innate, humoral and cell mediated immunity.	CO1 CO2	K1 K2 K3 K4
UNIT-II	Antigen and Antibody: Antigens - Properties of haptens, epitopes, adjuvants, and cross reactivity; Antibodies- structure, properties, classes; Antigen and Antibody Reactions: precipitation, agglutination, complement fixation, Vaccines – active and passive immunization; Classification of vaccines; Types of vaccine - antibacterial, antiviral; Vaccination schedule.	CO1 CO2 CO3 CO5	K1 K2 K3
UNIT-III	Immunoassay and Immunotechniques - Preparation and standardization of bacterial antigens; Raising of monoclonal and polyclonal antibodies; Purification of antibodies. Immunotechniques - RIA, RAST, ELISA, Immuno fluorescence techniques and Flow cytometry.	CO2 CO4 CO5	K1 K2 K3

UNIT-IV	Transplantation and Tumor Immunology - MHC Antigens - structure and function; HLA system - Regulation and response to immune system; Transplantation immunology - tissue transplantation and grafting; Mechanism of graft acceptance and rejection.	CO2 CO3 CO4 CO5	K1 K2 K3
UNIT-V	Immunological disorders and diseases - Hypersensitivity reactions (Type I, II, III and IV); acquired immunodeficiency syndrome; Auto immune disorders and diseases: organ specific and non organ specific.	CO2 CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5th Edition, Wiley-Blackwell, New York

2. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition. W. H. Freeman and Company, New York.

3. Abul K. Abbas, Andrew H. Lichtman, Shiv Pillai. (2021). Cellular and Molecular Immunology, 10th Edition. Elsevier.

4. Robert R. Rich, Thomas A. Fleisher, William T. Shearer, Harry Schroeder, Anthony J. Frew, Cornelia M. Weyand. (2018). Clinical Immunology: Principles and Practice, 5th Edition. Elsevier.

5. Pravash Sen. Gupta. (2003). Clinical Immunology. Oxford University Press.

Reference Books

1.Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.

2 Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11th Edition.,Wiley-Blackwell.

3 William R Clark. (1991). The Experimental Foundations of Modern Immunology. 3rd Edition. John Wiley and Sons Inc. New York.

4 Frank C. Hay, Olwyn M. R. Westwood. (2002). Practical Immunology, 4th Edition. Wiley-Blackwell.

5 Noel R. Rose, Herman Friedman, John L. Fahey. (1986). Manual of Clinical Laboratory Immunology. ASM.3rd Edition.

Website and e-learning source

1 https://www.ncbi.nlm.nih.gov/books/NBK279395/

2 https://med.stanford.edu/immunol/phd-program/ebook.html

3 https://ocw.mit.edu/courses/hst-176-cellular-and-molecular-immunology-fall2005/pages/lecture-notes/

4 Immunology Overview - Medical Microbiology - NCBI Bookshelf (nih.gov)

5 Immunology - an overview | Science Direct Topics

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	Assess the fundamental concepts of immunity, contributions of the organs and cells in immune responses.	K1, K2, K3, K4
CO2	Investigate the structures of Ag and Ab; Immunization.	K1, K2, K3
CO3	Justify the Immunoassay and Immunotechniques.	K1, K2, K3
CO4	Explain about the immunologic processes governing graft rejection and therapeutic modalities for immunosuppression in transplantation	K1, K2, K3
CO5	Analyze the over reaction by our immune system leading to hypersensitive conditions and its consequences.	K1, K2, K3, K4

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

COURSE DESCRIPTORS

Title of the Course	Practical IV- IMMUNOLOGY AND IMMUNOTECHNOLOGY	Hours/Week	05
Course Code	AUCPMB42	Credits	05
Category	Core VIII	Year & Semester	II & IV
Prerequisites	Biology	Regulation	2024

- **Objectives of the course:**
- To gain hands-on knowledge to identify Blood group and typing.
- To acquire adequate skill to perform latex agglutination reactions.
- To analyze precipitation reactions in gels.
- To investigate the antigen & antibody reactions in electrophoresis.
- To familiarize with Separation of Lymphocytes.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Identification of blood group and typing.	CO1 CO2	K1 K2 K3 K4
UNIT-II	Widal Test, Differential Count, T cell identification (Demonstration) Latex Agglutination reactions- RF, ASO, CRP test.	CO1 CO2 CO4	K1 K2 K3 K4
UNIT-III	Ouchterlony's Double Diffusion Method (antigen pattern). Single Radial Immuno Diffusion Method.	CO1 CO2 CO4	K1 K2 K3 K4

UNIT-IV	Electrophoresis - Serum, Counter and Immuno Electrophorosis	CO1 CO2 CO3 CO4	K1 K2 K3 K4
UNIT-V	Separation of Lymphocytes by gradient centrifugation method. ELISA.	CO2 CO3 CO5	K1 K2 K3 K4 K5

Recommended Text Books

1.Talwar. (2006). Hand Book of Practical and Clinical Immunology, Vol. I, 2nd edition, CBS.

2. Asim Kumar Roy. (2019). Immunology Theory and Practical, Kalyani Publications.

3. Richard Coico, Geoffrey Sunshine, Eli Benjamini. (2003). Immunology – A Short Course. 5thEdition., Wiley-Blackwell, New York.

4. Judith A.Owen, Jenni Punt, Sharon A. Stranford, Janis Kuby. (2013). Immunology, 7th Edition., W. H. Freeman and Company, New York.

5. Pravash Sen. Gupta. (2003). Clinical Immunology. Oxford University Press.

Reference Books

1.Frank C. Hay, Olwyn M. R. Westwood. (2008). Practical Immunology, 4th Edition, Wiley-Blackwell.

2 Wilmore Webley. (2016). Immunology Lab Manual, LAD Custom Publishing.

3 Rose. (1992). Manual of Clinical Lab Immunology, ASM.

4 Janeway Travers. (1997). Immunobiology- the immune system in health and disease. Current Biology Ltd. London, New York. 3rd Edition.

5 Peter J. Delves, Seamus Martin, Dennis R. Burton, Ivan M. Roitt. (2006). Roitt's Essential Immunology, 11thEdition., Wiley-Blackwell.

Website and e-learning source

1. https://www.researchgate.net/publication/275045725_Practical_Immunology-_A_Laboratory_Manual

2.https://www.urmc.rochester.edu/MediaLibraries/URMCMedia/labs/frelingerlab/documents/Immunology-Lab-Manual.pdf

3 https://webstor.srmist.edu.in/web_assets/downloads/2021/18BTC106J-lab-manual.pdf

4 Immunology Overview - Medical Microbiology - NCBI Bookshelf (nih.gov)

5 Immunology - an overview | ScienceDirect Topics

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	Assess the blood groups and types	K1, K2, K3, K4
CO2	Competently perform serological diagnostic tests such as RF, ASO, CRP	K1, K2, K3, K4
CO3	Illustrate the antigen antibody reactions in gel.	K1, K2. K3, K4
CO4	Compare & contrast antigens and antibodies in electrophoresis	K1, K2. K3, K4
CO5	Examine the concept of ELISA.	K1, K2. K3, K4, K5

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

COURSE DESCRIPTORS

Title of the Course	FOOD PROCESSING TECHNOLOGY	Hours/Week	03
Course Code	AUEMB43	Credits	03
Category	Elective IV	Year & Semester	II & IV
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- To provide knowledge on objectives of food preservation.
- To explain the freshness criteria and quality assessment of meat and fish
- To outline the methods of milk processing and fermented milk products.
- To explain the importance of fat and oil processing.
- To discuss the methods of microbiological examination of foods.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Introduction to food preservation –objectives and techniques of food preservation. Preservation: principles of high temperature, low temperature, radiation, chemical preservatives and bio preservatives.	CO1 CO3	K1 K2 K3 K4
UNIT-II	Freshness criteria and quality assessment of meat and fish –spoilage and methods of preservation. Production of byproducts after processing waste and their utilization. Role of packaging material, types of packaging material.	CO1 CO2 CO3	K1 K2 K3 K4
UNIT-III	Composition of milk; assessment of milk, thermal processing of fluid milk-pasteurization (LTH, HTST&UHT techniques). Fermented milk products-cheese, Butter milk, Yogurt, Kumis, Kefir and Acidophilus milk. Hygiene and sanitation requirement in food processing and fermentation industries. FSSAI	CO1 CO3 CO4 CO5	K1 K2 K3 K4
UNIT-IV	Importance of fats and oils in Food-Extraction of fats and Oils Rendering, pressing, solvent extraction, pressing of oil- degumming, refining, bleaching, deodorization, fractionation, pyrolysis of fats, toxicity of frying oil.	CO1 CO2 CO3	K1 K2 K3

UNIT-V	Food Sanitation, Methods for the microbiological examination of foods. Food borne illness and diseases. Microbial cultures for food fermentation. Indian Factories Act on safety, HACCP, Safety from adulteration of food.	CO1 CO2 CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1.Avantina Sharma. (2006). Text Book of Food Science and Technology, International Book Distributing Co, Lucknow, UP.

2. Sivasankar. (2005). Food Processing and Preservation, 3rd Edition.,Prentice hall of India Pvt Ltd, New Delhi.

3 Ramaswamy H & Marcotte M. (2006). Food Processing: Principles & Applications. Taylor & Francis.

4 NIIR Board of Food and Technologist. (2005). Modern Technology of Food Processing and Agrobased industries, National Institute of Industrial Research, Delhi.

5 Adams M.R. and Moss M. O (2007).Food Microbiology.New Age International..

Reference Books

1.Fellos PJ. (2005). Food Processing Technology: Principle &Practice 2ndEdition. CRC.

2 Peter Zeuthen and Leif Bogh-Sorenson. (2005). Food Preservation Techniques, WoodlandPublishing Ltd, Cambridge, England.1

3 Gustavo V. Barbosa-Canovas, Maria S. Tapia, M. Pilar Cano. (2004). Novel Food Processing Technologies, CRC.

4 Suman Bhatti, Uma Varma. (1995). Fruit and vegetable processing organizations and institutions, 1st Edition., CBS Publishing, New Delhi.

5 MirdulaMirajkar, Sreelatha Menon. (2002). Food Science and Processing Technology Vol-2, Commercial processing and packaging, Kanishka publishers, New Delhi.

Website and e-learning source

1 https://sites.google.com/a/uasd.in/ecourse/food-processing-technology

2 https://nptel.ac.in/courses/126105015

3 https://engineeringinterviewquestions.com/biology-notes-on-food-adulteration/

4 food processing | Definition, Purpose, Examples, & Facts | Britannica

5 Food Processing Technology | Food News & Views Updated Daily (foodprocessingtechnology.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	Assess the fundamental concepts of food preservation.	K1, K2, K3
CO2	Investigate the quality assessment of meat and fish.	K1, K2, K3, K4
CO3	Design the processing of milk and milk quality assessment.	K2, K3, K4
CO4	Explain about the importance of fats and oils.	K1, K2, K3
CO5	Plan the food safety and adulteration detection.	K1, K2, K3

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

COURSE DESCRIPTORS

Title of the Course	**VACCINE TECHNOLOGY**	**Hours/Week**	03
Course Code	**AUSMB44**	**Credits**	02
Category	**Skill Enhancement Course VI**	**Year & Semester**	II & IV
Prerequisites	Biology	**Regulation**	2024

Objectives of the course:

- To provide knowledge on the basics of immunization and induction of immunity.
- To learn the types of vaccines, its immunological effects and regulatory guidelines.
- To learn the role of rDNA in vaccine technology.
- To provide the knowledge on conventional to recent technology of vaccine production
- To learn about ethical issues and regulations in vaccine production and clinical trials

UNITS	Contents	COs	Cognitive Levels
UNIT-I	History of vaccination, Active and passive immunization; requirements for induction of immunity, Epitopes, MHC and immunogenicity.	CO1 CO2 CO4	K1 K2 K3 K4
UNIT-II	Viral/bacterial/parasite vaccine differences, methods of vaccine preparation – Live, killed, attenuated, sub unit vaccines; Licensed vaccines, Viral Vaccine - Poliovirus vaccine-inactivated & Live, Rabies vaccines, Hepatitis A & B vaccines, Bacterial Vaccine - Anthrax vaccines, Cholera vaccines, Diphtheria toxoid, Parasitic vaccine - Malaria Vaccine.	CO1 CO2 CO3 CO4	K1 K2 K3 K4
UNIT-III	Vaccine technology- Role and properties of adjuvants, recombinant DNA and protein-based vaccines, plant based vaccines, reverse vaccinology; Peptide vaccines, conjugate vaccines. Vaccination schedule	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4

UNIT-IV	Fundamental research to rational vaccine design. Antigen identification and delivery, T-Cell expression cloning for identification of vaccine targets for intracellular pathogens, Rationale vaccine design based on clinical requirements: Scope of future vaccine strategies.	CO2 CO3 CO4	K1 K2 K3 K4
UNIT-V	Vaccine additives and manufacturing residuals, Regulation and testing of vaccines, Regulation of vaccines in developing countries, Quality control and regulations in vaccine research, Animal testing, Rational design to clinical trials, Large scale production, Commercialization. Vaccine safety ethics and Legal issues. Vaccination Schedule	CO1 CO2 CO4 CO5	K1 K2 K3 K4

Recommended Text Books

1.Ronald W. Ellis.(2001). New Vaccine Technologies. Landes Bioscience.

2. Cheryl Barton. (2009). Advances in Vaccine Technology and Delivery. Espicom Business Intelligence.

3 Male, David. Ed. (2007). Immunology. 7th Edition. Mosby Publication. 47

4 Kuby, RA Goldsby, Thomas J. Kindt, Barbara, A. Osborne. (2002). Immunology. 6th Edition, Freeman.

5 Brostoff J, Seaddin JK, Male D, Roitt IM. (2002). Clinical Immunology. 6th Edition, Gower Medical Publishing

Reference Books

1. Stanley A. Plotkin, Walter Orenstein& Paul A. Offit.(2013). Vaccines, 6th Edition. BMA Medical Book Awards Highly Commended in Public Health. Elsevier Publication.

2 Coico, R. etal. (2003). Immunology: A Short Course. 5th Edition, Wiley – Liss.

3 Parham, Peter.(2005). The Immune System. 2nd Edition, Garland Science.

4 Abbas, A.K. etal. (2007). The Cellular and Molecular Immunology. 6th Edition, Sanders / Elsevier.

5 Weir, D.M. and Stewart, John (2000). Immunology. 8th Edition, Churchill Pvt. Ltd.

Website and e-learning source

1.https://www.slideshare.net/adammbbs/pathogenesis-3-rd-internal-updated-43458567

2.https://www.bio.fiocruz.br/en/images/stories/pdfs/mpti/2013/selecao/vaccineprocesstechnology.pdf

3.https://www.dcvmn.org/IMG/pdf/ge_healthcare_dcvmn_introduction_to_pd_for_vaccine_ production_29256323aa_10mar2017.pdf

4.https://www.sciencedirect.com/science/article/pii/B9780128021743000059

5.https://www.researchgate.net/publication/313470959_Vaccine_Scaleup_and_Manufacturing

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 significance of critical antigens, immunogens and adjuvants in developing effective vaccines.	K1, K2, K3
CO2	Understand the types of vaccines.	K1, K2
CO3	Construct vaccine applying rDNA technology.	K1, K2, K3, K4
CO4	Formulate the strategies for developing an innovative vaccine technology with different mode of vaccine delivery.	K1, K2, K3, K4
CO5	Evaluate the regulatory issues and guidelines for the management of vaccine production.	K1, K2, K3, K4

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

COURSE DESCRIPTORS

Title of the Course	APICULTURE	Hours/Week	02
Course Code	AUSMB45	Credits	02
Category	Skill Enhancement Course VII	Year & Semester	II & IV
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- To understand the biology of honey bees.
- To study on honey bee colony establishment.
- To develop knowledge on honey extraction.
- To understand the diseases of honey bees and their control.
- To gain information on financial assistance and funding agencies for bee keeping industry.

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Biology of Bees: Honeybee – Systematic position – Species of Honey bees – Life history of Honey bee – behaviour – swarming – Pheromone.	CO1 CO2 CO3 CO4	K1 K2 K3 K4
UNIT-II	Social life in Bees:Bee colony – Castes – natural colonies and their yield – Types of bee hives – Structure – location, care and management.	CO1 CO2 CO3 CO4	K1 K2 K3 K4
UNIT-III	Bee Rearing: Apiary – Care and Management – Artificial bee hives – types – construction of spaceframes – Selection of sites – Handling – Maintenance – Instruments employed in Apiary – Extraction instruments.	CO1 CO2 CO3 CO4	K1 K2 K3 K4

UNIT-IV	Bee Economy: Honey – Composition – uses – Bee wax and its uses – yield in national and international market – Diseases of honey bees and their control methods. Economics of bee culture.	CO1 CO3 CO4 CO5	K1 K2 K3 K4
UNIT-V	Entrepreneurship: venture – Preparing proposals for financial assistance and funding agencies – Bee Keeping Industry – Recent Efforts, Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens	CO3 CO4 CO5	K1 K2 K3 K4

Recommended Text Books

1.Dewey M. Caron. (2013). Honey Bee Biology and Beekeeping. Revised Edition. Wicwas Press, Kalamazoo. ISBN 10: 1878075292

2. R. A. Morse. (1993). Rearing queen honey bees. Wicwas press, NY. ISBN-10 : 1878075055

3. Ted Hooper. (2010). Guide to Bees & Honey: The World's Best Selling Guide to Beekeeping. Northern Bee Books. Oxford. ISBN 10: 1904846513

4. Jayashree K. V., Tharadevi C.S. and Arumugam N. (2014) Apiculture. Saras Publication

5. Raj H. (2020).Vinesh Text Book of Apiculture. S. Vinesh and Co

Reference Books

1.Dewey M. Caron. (2020). The Complete Bee Handbook: History, Recipes, Beekeeping Basics, and More,Rockridge Press. ISBN-10 : 1646119878

2 Joachim Petterson. (2016). Beekeeping: A Handbook on Honey, Hives & Helping the Bees, Weldon Owen.

3 Eva Crane. (1999). The World History of Beekeeping and Honey Hunting. Routledge. India.ISBN-10 : 0415924677

4 Pagar B. S. (2016). Textbook Of Apiculture. Sahitya Sagar.

5 Sehgal P.K. (2018). Text Book of Sericulture, Apiculture and Entomology.Kalayani.

Website and e-learning source

1.Bee Keeping Basics. Retrieved from:https://denton.agrilife.org/files/2013/08/beekeeping basics.pdf

2. Beekeeping as an Entrepreneurship, Retrieved from: https://lupinepublishers.com/agriculture-journal/pdf/CIACR.MS.ID.000270.pdf

3. Raising Bumble Bees at Home: A Guide to Getting Started. Retrieved from: https://www.ars.usda.gov/ARSUserFiles/20800500/BumbleBeeRearingGuide.pdf

4. Apiculture – Biology for Everybody (homeomagnet.com)

5. Apiculture: Introduction to Apiculture (iasri.res.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	Understand the systematic position and life history of honey bee.	K1, K2
CO2	Reveal the different stages and types of bees and discuss about the care and management of apiculture.	K1, K2, K3, K4
CO3	Describe the practice of bee rearing process and analyze instruments employed in apiary.	K1, K2, K3, K4
CO4	Compare and contrast the composition of honey and bee wax and interpret the yield in National and International markets.	K1, K2, K3, K4
CO5	Able to Assist financing and funding agencies and reveal the modern techniques employed in artificial bee hives.	K1, K2, K3

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

COURSE DESCRIPTORS

Title of the Course	MICROBIOLOGY II	Hours/Week	03
Course Code	AUAEMB43	Credits	03
Category	ELECTIVE IV	Year & Semester	II & IV
Prerequisites	Biology	Regulation	2024

Objectives of the course:

- *To learn the Bacterial and Viral diseases.*
- *To understand the Fungal and Protozoan diseases.*
- *To impart knowledge about the Environmental Microbiology.*
- *To acquire knowledge about the Food Microbiology*
- *To familiarize the biofertilizers and biopesticides*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Bacterial diseases – Symptoms and control of Respiratory Diseases: S. pyogenes, *M. tuberculosis* Gastrointestinal Diseases: E. coli, *S. typhi, Vibrio cholerae*. Fungal diseases - Causative organism, Symptoms and control Cutaneous mycoses: *Tinea pedis* (Athlete's foot) Systemic mycoses: Histoplasmosis Opportunistic mycoses: Candidiasis.	CO1 CO2 CO4 CO5	K1 K2 K3 K4
UNIT-II	Viral diseases – Causative organism, Symptoms and control of Polio, Hepatitis, Rabies, Dengue, AIDS, Influenza with brief description of swine flu, Ebola, Chikungunya. Protozoan diseases - Causative organism, Symptoms, mode of transmission and control Malaria, Amoebiais.	CO1 CO2 CO4 CO3 CO5	K1 K2 K3 K5
UNIT-III	Microbiology of Air – Sources of air borne organisms, Air borne diseases. Water borne diseases; Purification of water. Sewage treatment – Physical, Chemical and Biological methods	CO1 CO2 CO4	K1 K2 K3 K4

UNIT-IV	Sources of contamination and spoilage of foods; Food Preservation; Fermentation products - Bread and Alcoholic beverages (Beer & Wine); Fermented dairy products – Cheese & Yogurt. SCP- *Spirulina* and *Mushroom*.	CO1 CO2 CO3 CO4	K1 K2 K3
UNIT-V	Biofertilizers – Definition, Types, Importance and Advantages; Nitrogen fixing microorganisms; Phosphate solubilizing microorganisms; Biopesticides.	CO2 CO3 CO4 CO5	K1 K2 K3 K4

Recommended Text Books

1.Kanunga R. (2017). Ananthanarayanan and Panicker's Text book of Microbiology. (10th Edition). Universities Press (India) Pvt. Ltd.

2 Dubey, R.C. and Maheshwari D.K. (2010). A Text Book of Microbiology. S. Chand & Co.

3 Rajan S. (2007). Medical Microbiology. MJP publisher.

4 Arora, D. R. and Arora B. B. (2020). Medical Parasitology. (5th Edition). CBS Publishers & Distributors Pvt. Ltd. New Delhi.

5 Frazier WC and Westhoff DC (2014). Food Microbiology. Tata McGraw Hill Publishing Company Ltd. New Delhi

6 Subba Rao. N. S. (2017). Soil Microbiology. (5th Edition). MedTech Publishers.

7 Daniel. C. J. (2006). Environmental Aspects of Microbiology. (2nd Edition). Bright Sun Publications.

Reference Books

1.Salle A. J. (2007). Fundamental Principles of Bacteriology. (4th Edition). Tata McGrawHill Publications.

2 Collee J.C. Duguid J.P. Foraser, A.C, Marimon B.P, (1996). Mackie & McCartney Practical Medical Microbiology. 14thedn, Churchill Livingston.

3 Pepper I. L., Gerba C. P. and Gentry T. J. (2014). Environmental Microbiology (1st Edition). Academic Press, Elsevier.

4 Bitton, G. (2011). Wastewater Microbiology. (4th Edition). Wiley-Blackwell.

5 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 http://textbookofbacteriology.net/nd

2 https://www.adelaide.edu.au/mycology/

3 https://en.wikipedia.org/wiki/Virology

4 www.environmentshumail.blogspot.in/

5 http://www.fsis.usda.gov/

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 of common bacterial and fungal diseases.	K1, K2
CO2	Gain Knowledge of common viral and protozoan diseases.	K1, K2
CO3	Understand the air, water and waste water microbiology	K1, K2
CO4	Understand the food and dairy microbiology	K1, K2
CO5	Utilize the knowledge of biofertilizers and biopesticides. for sustainable agriculture.	K1, K2, K3, K4

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

COURSE DESCRIPTORS

Title of the Course	PRACTICAL MICROBIOLOGY	Hours/Week	03
Course Code	AUAEPMB43	Credits	03
Category	Elective Practical	Year & Semester	II & IV
Prerequisites	Higher Secondary / Chemistry / Biology / Mathematics/Botany/Zoology/ Physics	Regulation	2024-25

Objectives of the course:

- *To acquire knowledge on cleaning of glassware's and sterilization.*
- *To gain knowledge on media preparation and cultural characteristics.*
- *To learn the pure culture technique*
- *To learn the microscopic techniques and staining methods.*
- *To acquire knowledge to isolate the microorganisms from the environment*

UNITS	Contents	COs	Cognitive Levels
UNIT-I	Cleaning of glassware's, Microbiological good laboratory practice and safety. Sterilization of glassware's and media.	CO1 CO3 CO4	K1 K2 K3
UNIT-II	Culture Media and its Preparation preparation: liquid and solid media.	CO1 CO2 CO3	K1 K2 K3
UNIT-III	Pure culture techniques: Streak plate, Serial dilution – spread plate and pours plate. Antibiotic sensitivity testing–Kirby Bauer method.	CO1 CO2 CO3	K1 K2 K3
UNIT-IV	Staining techniques: Smear preparation, simple staining, and Gram's staining and Capsule staining. Motility demonstration: Hanging drop technique. Fungal identification by Lactophenol cotton blue staining technique.	CO3 CO4 CO5	K1 K2 K3

UNIT-V	Isolation of microorganisms from Water, Air, soil and sewage. Testing the quality of milk-MBRT	CO3 CO5	K1 K2 K3 K4

Recommended Text Books

1. James G Cappucino and N.Sherman MB(1996).A lab manual Benjamin Cummins, NewYork 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, NewDelhi.

5. RC Dubey and DK Maheswari (2002).Practical Microbiology.S.Chand Publishing.

Reference Books

1.Atlas, R. (1997). Principles of Microbiology*, 2nd Edition, W.M.C. Brown Publishers.*

2.Amita, J., Jyotsna, A., and Vimala, V. (2018). Microbiology Practical Manual *(1st Edition). Elsevier India.*

3. Talib, V.H. (2019). Handbook of 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.	K1, K2, K3
CO2	Prepare different media and their quality control.	K1, K2, K3
CO3	Streak plate, pour plate and serial dilution, and pigment production of microbes.	K1, K2, K3
CO4	Understand microscopy methods, different staining techniques, and motility test.	K1, K2, K3
CO5	Acquire knowledge to isolate bacteria from the environment.	K1, K2, K3

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