Marudhar Kesari Jain College for Women (Autonomous)

Vaniyambadi–635751

Department of Microbiology

For

Undergraduate Programme

Bachelor of Science in Microbiology

From the Academic Year 2025-2026

LEARNING OUTCOMES BASED CURRICULUM FRAME WORK FOR UNDERGRADUATE AND POSTGRADUATE EDUCATION

1.Preamble

The Department of Microbiology at Marudhar Kesari Jain College for Women, Vaniyambadi, is proud to introduce the Bachelor of Science (B.Sc.) in Microbiology, a transformative program designed to empower young women with knowledge, skills, and opportunities in the field of life sciences.

Microbiology, the study of microorganisms and their impact on humans, animals, plants, and the environment, is a dynamic and interdisciplinary field with immense relevance in today's world. From combating infectious diseases to advancing biotechnology, food safety, and environmental conservation, microbiology plays apivotal role in addressing global challenges.

This undergraduate program offers a comprehensive curriculum, blending theoretical foundations with practical training in modern laboratories. With a focus on emerging trends such as molecular biology, immunology, and industrial microbiology, the course prepares students for diverse career opportunities in healthcare, research, agriculture, pharmaceuticals, and more.

Guided by a team of experienced faculty and supported by state-of-the-art facilities, the B.Sc. Microbiology program emphasizes holistic education, critical thinking, and innovation. Our commitmentis to nurture the scientific temperament, ethical values, and leadership qualities of our students, enabling them to excel as professionals and contribute meaningfully to society. We welcome aspiring microbiologists to embark on this exciting academic journey at Marudhar Kesari Jain College for Women, where tradition meets excellence, and learning empowers lives.

LEARNING OUTCOMES-BASED CURRICULUM FRAMEWORK FOR UNDERGRADUATE EDUCATION	
Programme	**B.Sc., Microbiology**
Programme Code	**US14**
Duration	**3 years[UG]**
Programme Outcomes	**PO1: Disciplinary knowledge:** Capable of demonstrating comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate Programme of study. **PO2: Communication Skills:** Ability to express thoughts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself;demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to different groups. **PO3:Critical thinking:** Capability to apply analytic thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments;critically evaluate practices, policies and theories by following scientific approach to knowledge development. **PO4: Problem solving: Capacity** to extrapolate from what one has learned and apply their competencies to solve different kinds of non-familiar problems,ratherthan replicate curriculum content knowledge;and apply one's learning to real life situations. **PO5: Analytical reasoning**: Ability to evaluate the reliability and relevance of evidence; identify logical flaws andholes in the arguments of others; analyze and synthesize data from a variety of sources;draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints. **PO6: Research-related skills**: A sense of inquiry and capability for asking relevant/appropriate questions, problem arising, synthesising and articulating; Ability to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; ability to plan, execute and report the results of an experiment or investigation. **PO7: Cooperation / Teamwork:** Ability to work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a member of a team. **PO8:Scientific reasoning**: Ability to analyse, interpret and draw conclusions from quantitative/qualitative data; and critically evaluate ideas, evidence, and experiences from an open-minded and reasoned perspective.

	PO9: Reflective thinking: Critical sensibility to lived experiences, withself-awareness and reflexivity of both self and society. **PO10Information/digitalliteracy:** Capability to use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data. **PO 11 Self-directed learning**: Ability to work independently, identify appropriate resources required for a project, and manage a project through to completion. **PO12Multiculturalcompetence:** Possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups. **PO 13: Moral and ethical awareness/reasoning**: Ability to embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives,and use ethical practices in all work. Capable of demonstrating the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopting objective, unbiased and truthful actions in all aspects of work. **PO14:Leadershipreadiness/qualities:** Capability for mapping out the tasks of a team oran organization, and setting direction, formulating an inspiring vision, building a team who can help achieve the vision, motivating and inspiring team members to engage with that vision, and using management skills to guide people to the right destination, in a smooth and efficient way. **PO 15: Lifelong learning:** Ability to acquire knowledge and skills, including learning how to learn", that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.
Programme Specific Outcomes:	**PSO1 –Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions. **PSO2 - Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving,decision making and leadership skills that will facilitate startups and high potential organizations. **PSO3–Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards Growth and development. **PSO4–Contribution to Business World:** To produce employable, ethical, and innovative professionals to sustain in the dynamic business world. **PSO5–Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit.

PROGRAM OUTCOMES

PO1	Acquire knowledge in the field of biological sciences.
PO2	Develop critical,analytical thinking and problem-solving skills.
PO3	Develop research related skills in defining the problem, formulate and test the hypothesis, analyse, interpret, and draw conclusion from data.
PO4	Address and develop solutions for societal and environmental needs of local, regional and national development.
PO5	Work independently and engage in life long learning and enduring proficient progress.
PO6	Provoke employability and entrepreneurship among students along with thics and communication skills.
PO7	Understand the importance of ethical behavior in business contexts and be able to recognize and address ethical dilemmas they may encounter in their professional careers.
PO8	Prepared for lifelong learning and professional development, including the ability to adapt to changes in technology,business practices,and economic conditions through out their careers.

PROGRAM SPECIFIC OUTCOMES

PSO1	**Foundational Knowledge and Skills** Develop a strong understanding of core microbiological concepts, including microbial physiology,genetics,immunology,and biotechnology. Gain hands-on expertise in laboratory techniques such as microbial isolation, culturing, and molecular diagnostics, fostering Proficiency in scientific experimentation and analysis.
PSO2	**Application in Multidisciplinary Fields** Apply microbiological knowledge to diverse domains such as healthcare, environmental science,food technology, and pharmaceuticals. Demonstrate the ability to address real- world challenges through innovative solutions, such as developing sustainable practices, combating Infectious diseases, and enhancing industrial processes.
PSO3	**Research and Ethical Leadership** Cultivate a scientific temperament and critical thinking skills to conduct research, analyze data, and interpret results effectively. Emphasize ethical practices and environmental consciousness in microbiological studies, preparing graduates to contribute responsibly to advancementsinscienceand technology.

Eligibilityfor Admission:

The candidate must have successfully completed Higher Secondary (10+2) education from a recognized board. They should have studied **Biology** as a mandatory subject, along with **Physics** and **Chemistry** in their 10+2 curriculum.

Methods of Evaluation and Assessment

Methods of Evaluation		
Internal Evaluation		25 Marks
External Evaluation	End Semester Examination	75 Marks
	Total	**100 Marks**
Methods of Assessment		
Recall(K1)	Simple definitions, MCQ, Recall steps, Concept definitions	
Understand/ Comprehend(K2)	MCQ, True/False, Short essays, Concept explanations, short summary or overview	
Application(K3)	Suggest idea/concept with examples, suggest formulae, solve problems, Observe, Explain	
Analyze(K4)	Problem-solving questions, finish a procedure in many steps, Differentiate Between various ideas, Map knowledge	
Evaluate(K5)	Longer essay/Evaluation essay, Critique or justify with pros and cons	
Create(K6)	Check knowledge in specific or offbeat situations, Discussion, Debating or Presentations	

Semester–I						
Code	Course Title	HoursDistribution				C
		L	T	P	S	
24UFTA11	Tamil– I	4	1	0	0	3
24UFEN11	English– I	4	1	0	0	3
25UMBC11	CC–1FundamentalsofMicrobiology and Microbial Diversity	3	1	2	0	5
25UMBC12P	CC–2 CorePractical I Fundamentals of Microbiolgy and Microbial Diversity Practical	0	0	4	0	3
24UBCA11	EC- 1Allied Biochemistry I	3	1	0	0	3
25UBCS11	SEC – 1 Social andPreventivemedicine	1	0	1	0	2
24UBCS12P	SEC – 2 Allied Biochemistry - I Practical	1	0	1	0	2
25UMBF11	FC-Introductiontomicrobialworld	1	1	0	0	2
					30	**23**

Semester-II						
Code	Course Title	HoursDistribution				C
		L	T	P	S	
24UFTA21	Tamil– 2	4	1	0	0	3
24UFEN21	English – 2	4	1	0	0	3
25UMBC21	CC–3MicrobialPhysiology and Metabolism	3	1	2	0	5
25UMBC21P	CC-4Core Practical II Microbial Physiology and Metabolism Practical	0	0	3	0	2
24UBCA21	EC– 2 Allied Biochemistry II	3	1	0	0	4
24UBCA21P	EC–3 Allied Biochemistry - II Practical	0	0	3	0	2
25UMBS21	SEC – 3 Bioinstrumentation	1	0	1	0	2
24UAEC21	AEC– 1Life skills through yoga	1	1	0	0	2
					30	**23**

Semester–III						
	Tamil– 3	4	1	0	0	3
	English– 3	4	1	0	0	3
	CC–5Molecular biology and MicrobialGenetics	3	1	2	0	5
	CC-6Practical IIIMicrobialGenetics and Molecularbiology	0	0	3	0	2
	EC–3 Clinical Laboratory Technology	3	1	0	0	4
	SEC 5 - Microalgal Technology	0	0	3	0	2
	SEC–6OrganicFarming&Biofertilizer Technology	1	0	1	0	2
	AEC–2HumanValuesandEthics	1	1	0	0	2
					30	**23**

Semester-IV						
	Tamil– 4	4	1	0	0	3
	English – 4	4	1	0	0	3
	CC–7ImmunologyandImmunotechnology	3	1	2	0	5
	CC - 8 Practical IVImmunologyandImmunotechnology	0	0	3	0	2
	EC-4Food Processing Technology	3	1	0	0	4
	SEC – 7 Vermitechnology	0	0	3	0	2
	SEC-8VaccineTechnology	1	0	1	0	2
	AEC– 3 EnvironmentalStudies	1	1	0	0	2
					30	**23**

Semester–V						
	CC-9Bacteriology and Mycology	4	1	0	0	4
	CC-10Practical V Medical Microbiology	0	0	3	0	2
	CC- 11 Virology and Parasitology	3	1	1	0	4
	CC-12Project with Viva- voce	0	0	3	0	2
	EC–5Recombinant DNA Technology	4	1	0	0	4
	EC–6Biosafety and Bioethics	4	1	0	0	4
	Value Education	1	1	0	0	2
	Intenship/Industrial Training/Field Visit				2	2
					30	**24**

Semester-VI						
	CC–13Environmental and Agricultural Microbiology	4	1	0	0	4
	CC - 14 Practical VI Environmental, Agriculture, Food, Dairy and Probiotic Microbiology	0	0	5	0	4
	CC-15Food, Dairy and Probiotic Microbiology	0	0	0	5	5
	EC–6 Pharmaceutical Microbiology	4	1	0	0	4
	EC–7Entrepreneurship and Bio business	4	1	0	0	4
	Extension Activity	1	1	0	0	2
	SLC–1Microbial Quality control and Testing				3	2
					30	**25**
					141+2*	

Students must complete at least one online course (MOOC) from platforms like SWAYAM, NPTEL, or Nanmudalvan within the fifth semester.Additionally,engaginginaspecifiedSelf-learningCourse ismandatorytoqualifyforthedegree,andsuccessful participation willbeacknowledged with anextracreditof2*.

Part–1&2	Tamil&English	8	SEC	SkillElectiveCourse (ME /NME)	5
CC	CoreCourse	15	FC	FoundationCourse	1
EC-AL	Elective Course –Allied / Generic	7	AEC	Ability EnhancementCourse	4
EC	Elective Course – Major	4	SLC	Self-LearningCourse	1

I[ST] YEAR FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UMBC11	**FUNDAMENTALS OF MICROBIOLOGY ANDMICROBIAL DIVERSITY**	Core CC-1	3	1	2	0	5	6	25	75	100

Learning Objectives	
LO1	Learn the fundamental principles about different aspects of Microbiology including Recent developments in the area.
LO2	Describe the structural organization, morphology and reproduction of microbes.
LO3	Explain the methods of cultivation of microbes and measurement of growth.
LO4	Understand the microscopy and other basic laboratory techniques–culturing, Disinfection and sterilization in Microbiology.
LO5	Compare and contrast the different methods of sterilization.

Unit	**Content**	**Hours**
1	**Evolution, Classification, and Biodiversity of Microorganisms:** History and evolution of microbiology, contributions of key scientists, theories on the origin of microorganisms. Classification – Three-kingdom, five-kingdom, six-kingdom, and eight-kingdom systems, modern molecular approaches to microbial taxonomy. Microbial biodiversity–Introduction to microbial diversity, ecological niches, and microbial roles in biogeochemical cycles. Basic concepts of prokaryotes and eukaryotes, characteristics and significance of Bacteria, Archaea (Archaebacteria),and eukaryotic microorganisms (Protozoa, Fungi, Algae).	18
2	**Characteristics and Structure of Microorganisms** General characteristics of cellular microorganisms (Bacteria, Algae, Fungi, and Protozoa) and acellular microorganisms (Viruses, Viroids, and Prions). Differences between prokaryotic and eukaryotic microorganisms. Structure of bacterial cell wall, cell membrane, capsule,flagella,pili,mesosomes,chlorosomes,phycobilisomes,spores,andgas vesicles.	18
3	**Microbial nutrition** Nutritional requirements of microorganisms - Macronutrients, micronutrients and growth factors. Nutritional types of microorganisms: Autotrophs and heterotrophs, phototrophs and chemotrophs. Physical factors affecting growth of microorganisms: Temperature, pH and Oxygen. Culture media: Components of media, Synthetic or defined media, Complex media, enriched media, selective media, differential media, enrichment culture media.	18
4	**Bacterial Growth** Concept of growth of microorganisms; measurement of growth; Culture	18

	system: concept of batch and continuous culture, growth kinetics in batch system emphasizing different phases of bacterial growth, specific growth rate, growth curve, diauxic growth. Counting of bacteria -Viable count, Total count and turbidimetric estimation.	
5	**Sterilization and Disinfection** Sterilization–moist heat(autoclaving),dry heat(hotair oven), radiation(UV, ionization),filtration(membrane filter). Disinfection and antiseptics. Antimicrobial agents.	18

CO	**Course Outcomes**
CO1	Study the historical events that led to the discoveries and inventions and understand the Classification of microorganisms.
CO2	Gain Knowledge of detailed structure and functions of prokaryotic cell organelles.
CO3	Understand the various microbiological techniques, different types of media, and Techniques involved in culturing microorganisms
CO4	Explain the principles and working mechanism of different microscopes/ Microscope, Their function and scope of application.
CO5	Understand the concept of asepsis and modes of sterilization and disinfectants.

Textbooks:	
1	Pelczar. M. J., Chan E.C.S. and Noel. R.K. (2007). Microbiology. 7thEdition., McGraw – Hill, New York.
2	WilleyJ.,SherwoodL.,andWoolvertonC.J.,(2017).Prescott'sMicrobiology.10th Edition.,McGraw-Hill International edition.
3	Salle. A.J (1992). Fundamental Principles of Bacteriology. 7thEdition., McGraw Hill Inc. New York.
4	Boyd,R.F.(1998).GeneralMicrobiology,2ndEdition.,TimesMirror,MosbyCollegePublishing, St Louis.
5	MadiganM.T.,MartinkoJ.M.,StahlD.A,andClark D.P.(2010).Brock -Biologyof Microorganisms, 13th Edition Benjamin-Cummings Pub Co
6	Sarma,S.,&Paniker,C.K.J.(2023).*AnanthanarayanandPaniker'sTextbookof Microbiology* (13th ed.). Universities Press.

ReferenceBooks:

1	JeffreyC.Pommerville.,Alcamo's Fundamentals of Microbiology(9thEdition).Jones &Bartlett learning 2010.
2	StanierR.Y,IngrahamJ.L.,WheelisM.L.,and PainterR.R.(2010).General Microbiology, 5thEdition., MacMillan Press Ltd
3	Tortora,G.J.,Funke,B.R.and,Case,C.L(2013).Microbiology-An Introduction, 11thEdition.,BenjaminCummings.
4	NesterE., AndersonD.,RobertsC.E.,and NesterM.(2006).Microbiology-A Human Perspective, 5thEdition., McGraw Hill Publications.
5	MadiganM.T.,MartinkoJ.M.,StahlD.A,andClarkD.P.(2010).Brock-Biologyof Microorganisms, 13th Edition Benjamin-Cummings Pub Co

Web resources:	
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/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	3	2	2	2	3	3	3	3	3
CO2	3	2	3	3	2	2	2	3	1	3	2
CO3	3	3	3	1	2	2	2	3	3	1	3
CO4	3	3	2	3	2	2	2	2	3	3	2
CO5	3	2	2	3	3	2	3	3	3	3	2
Total	15	13	13	12	11	10	12	14	13	13	12
Average	3	2.6	2.6	2.4	2.2	2.0	2.4	2.8	2.6	2.6	2.4

3–Strong, 2-Medium,1- Low

I[st] YEAR FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UMBC12P	**Practical I - Fundamentals of Microbiology and Microbial Diversity**	Core CC-2	0	0	4	0	3	4	25	75	100

Learning Objectives	
LO1	Understand and apply proper cleaning, sterilization, and safety techniques to maintain aseptic conditions in a microbiology laboratory..
LO2	Gain knowledge of microbiological media preparation, types, and quality control to Support microbial growth and identification.
LO3	Develop fundamental microbiological skills for isolating, culturing, and quantifying Bacteria using standard laboratory techniques..
LO4	Understand the principles and applications of microbiological instrumentation and Quantification techniques for microbial analysis.
LO5	Learn and apply staining, observation, and enumeration techniques to study microbial morphology, and diversity.

Unit	Content	Hours
1	**Laboratory Practices ,Sterilization, and Safety in Microbiology** • **Cleaning of Glassware:** Proper methods for washing, decontaminating, and preparing glassware for microbiological use. • **Microbiological Good Laboratory Practices (GLP) and Safety:** Essential guidelines for maintaining aseptic conditions, handling microorganisms, and ensuring laboratory safety. • **Sterilization Techniques:** Methods including autoclaving, hot air oven sterilization, and membrane filtration for ensuring sterility. • **Assessment of Sterility:** Verification procedures to confirm the effectiveness of sterilization techniques.	12
2	**Media Preparation and Quality Control in Microbiology** • **Types of Microbiological Media:** Preparation and applications of liquid, solid, and semi-solid media. • **Agar-Based Media Formats:** Preparation of agar slants, agar deeps, and agar plates for microbial cultivation. • **Specialized Culture Media:** Formulation and usage of basal, differential, enriched, enrichment, transport, and selective media. • **Quality Control of Culture Media:** Assessment of growth-supporting properties, sterility checks, and validation of media performance.	12
3	**Fundamental Microbiological Techniques and Bacterial Enumeration** • **Pure Culture Techniques:** Methods including streak plate, pour plate, and decimal dilution for isolating and maintaining	12

	Pure bacterial cultures. • **Bacterial Growth on Different Media:** Observing microbial growth characteristics and describing colony morphology on various culture media. • **Pigment Production in Bacteria:** Demonstrating and analyzing the production of pigments by different bacterial species. • **Enumeration of Bacteria from Environmental Samples:** Quantitative estimation of bacterial populations from soil, water, And air using standard microbiological techniques.	
4	**Microbiological Instrumentation and Quantification Techniques** • **Microscopy Techniques:** Principles and applications of light microscopy and bright-field microscopy for microbial observation. • **Colorimeter:** Usage and significance of a colorimeter in microbiological and biochemical assays. • **pH Meter:** Measurement and importance of pH in microbial growth and culture media preparation. • **Microbial Enumeration Methods:** Determination of microorganisms using direct count and viable count techniques.	12
5	**Microbial Staining, Observation, and Diversity Studies** • **Staining Techniques:** Smear preparation and staining methods, including simple staining, Gram's staining, and endospore staining, for bacterial identification. • **Microbial Diversity Analysis:** Examination of microbial Communities using Hay Infusion Broth.	12

CO	**Course Outcomes**
CO1	Demonstrate proficiency in laboratory best practices, including glassware cleaning, sterilization methods, and sterility assessment, ensuring compliance with microbiological safety standards.
CO2	Demonstrate competence in preparing various culture media, ensuring their quality through sterility checks and performance validation for reliable microbiological analyses.
CO3	Demonstrate proficiency in pure culture techniques, bacterial enumeration, and analysis Of microbial growth characteristics for accurate microbiological investigations.
CO4	Demonstrate proficiency in using microscopy, colorimetry, pH measurement, and Microbial enumeration methods for accurate microbial assessment.
CO5	Demonstrate competency in microbial staining, and diversity analysis to identify and Characterize microorganisms accurately.

Textbooks:	
1	James G Cappucino and N. Sherman MB(1996). A lab manual Benjamin Cummins, New York 1996.
2	Kannan.N(1996).LaboratorymanualinGeneralMicrobiology.PalaniPublications.
3	SundararajT(2005).Microbiology Lab Manual(1st edition) publications.

4	Gunasekaran,P.(1996).LaboratorymanualinMicrobiology.NewAgeInternational Ld., Publishers, New Delhi.
5	RCDubeyandD KMaheswari(2002).Practical Microbiology.S. Chand Publishing.
ReferenceBooks:	
1	Atlas.R(1997).PrinciplesofMicrobiology,2ndEdition,Wm.C.Brown publishers.
2	AmitaJ,JyotsnaA and VimalaV(2018). Microbiology Practical Manual.(1st Edition). Elsevier India
3	TalibVH(2019).HandbookMedicalLaboratoryTechnology.(2ndEdition).CBS.
4	WheelisM,(2010).PrinciplesofModernMicrobiology,1stEdition.Jonesand Bartlett Publication.
5	LimD.(1998).Microbiology,2ndEdition,WCBMcGrawHillPublications
Web resources:	
1	http://www.biologydiscussion.com/micro-biology/sterilisation-and-disinfectionmethods-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-tomicrobiology/a-brief-history-of-microbiology

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	1	3	3	3	3
CO2	3	2	3	3	3	3	1	3	3	3	3
CO3	3	3	3	3	2	3	1	3	3	3	3
CO4	3	3	2	2	3	3	1	3	3	3	3
CO5	3	3	3	3	2	3	1	3	3	3	3
Total	15	15	15	15	12	15	5	15	15	15	15
Average	3	3	3	3	3	3	1	3	3	3	3

3–Strong, 2-Medium,1- Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UBCS11	**SEC– 1NME** **Social and Preventive Medicine**	**NME**	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Describe the concepts of health and disease and their social determinants
LO2	Summarize the health management system
LO3	Know about the various health care services
LO4	Outline the goals of preventive medicine
LO5	Gain knowledge about alternate medicine

Unit	Content	Hours
1	**Social Medicine and Public Health** History of social medicine, concepts of health and disease, social determinants of health and disease. Health and quality of life,health Information systems, measures of population health, and health policies.	**6**
2	**Health Management and Disease Prevention** 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 andtheir control.	**6**
3	**Community Health and Health Education** Health care of the community–information, education, communication, and training in health. Maternal and child health. School health services.	**6**
4	**Preventive Medicine and Disease Control** Introduction to preventive medicine, role of preventive medicine, levels of prevention. Surveillance, monitoring, and reporting of disease outbreaks. Forecasting and control measures in community settings. Early detection methods.	**6**
5	**Traditional Medicine and Global Health Regulations in Epidemics** Unani, Ayurveda, Homeopathy, and Naturopathy systems in epidemic and pandemic outbreaks. International health regulations. Infectious disease outbreak case studies and precautionary responses during SARS,MERScoronavirus,Ebola,andnovelSARS-CoV-2outbreaks.	**6**

CO	CourseOutcomes
CO1	Identify the health information system
CO2	Associate various factors with health management system
CO3	Choose the appropriate healthcare services
CO4	Appraise the role of preventive medicine in community setting
CO5	Recommend the usage of alternate medicine during outbreaks

Textbooks:	
1	Park.K(2021).Textbookofpreventiveandsocialmedicine,26thedition. Banarsidas Bhanot publishers.
2	Mahajan&Gupta(2013). Text book of preventive and social medicine, 4thedition. Jaypeebrothersmedical publishers.
3	Chun-SuYuan,EricJ.Bieber,BrentBauer(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	LalAdarshPankajSunder(2011).Textbook of Community Medicine: Preventive and Social Medicine, CBS publisher
ReferenceBooks:	
1	HowardWaitzkin,AlinaPérez,MattAnderson(2021).SocialMedicineandthecoming Transformation. First Edition. Routledge publishers.
2	GNPrabhakara(2010).ShortTextbookofPreventiveandSocialMedicine.Second Edition. Jaypee publishers
3	JerryM. Suls, KarinaW.Davidson,RobertM. Kaplan(2010).Handbook of Health Psychology and Behavioral Medicine. Guilford Press..
4	MarieEloïseMuller,MarieMuller,MarthieBezuidenhout,KarienJooste(2006).Health Care Service Management. Juta and Company Ltd.
5	GeoffreyRose(2008).Rose'sStrategyofPreventiveMedicine:TheComplete.OUPOxford.
Webresources:	
1	https://www.omicsonline.org/scholarly/social--preventive-medicine-journals-articlesppts-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

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	3	3	3	2	3	2	3	1
CO2	3	3	2	2	3	3	3	2	3	2	3
CO3	3	1	3	3	3	3	2	1	2	2	3
CO4	3	3	1	3	3	3	2	3	1	3	2
CO5	3	3	2	2	3	2	1	3	2	1	2
Total	15	13	09	13	15	14	10	12	10	11	11
Average	3.0	2.6	1.8	2.6	3.0	2.8	2.0	2.4	2.0	2.2	2.2

3 – Strong, 2 - Medium, 1 - Low

1ST YEAR: FIRST SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UMBF11	**FC–1 Introduction to microbial world**	**FC**	**1**	**1**	**0**	**0**	**2**	**2**	**25**	**75**	**100**

Learning Objectives	
LO1	Describe the discovery of microbial world and development of pure culture techniques.
LO2	Learn about distribution of microorganism in nature, diversity and types of Microorganisms
LO3	Know about the impact of microorganism in environment-Branches of microbiology
LO4	Outline the goals of pure culture techniques
LO5	Gain knowledge about microscopy and staining techniques

Unit	Content	Hours
1	**Foundations of Microbiology and Medical Advances** Establishment of the theory of biogenesis. Discovery of viruses. Developments in pure culture techniques. Establishment of the germ theory of disease and fermentation. Work of Lister and principles of aseptic surgery. Discovery and development of vaccines and modern chemotherapy. Contributions of Winogradsky and Beijerinck. Discovery Of microorganisms as plant pathogens.	**6**
2	**Microbial Diversity and Classification** Diversity in microbial habitats. Types of microorganisms. Introduction to the prokaryotic world, eukaryotic microorganisms, viruses, and other acellular microorganisms.	**6**
3	**Microorganisms and Their Significance** Impact of microorganisms on the environment and human life. Branches of microbiology. Thrust areas of microbiology– genetic engineering and biotechnology.	**6**
4	**Pure Culture Techniques and Preservation** Definition of pure culture. Principles and methods of obtaining pure culture. Preservation of pure culture. Culture collection centers.	**6**

5	**Microscopy and Staining Techniques** Principles of microscopy, magnification, and resolving power. Light microscopy–simple and compound microscopes. Bright-field and dark-field microscopy. Principles and applications of phase-contrast and fluorescent microscopy. Electron microscopy–general principles, types, working mechanisms, and limitations. Staining – Nature of dyes. – Staining techniques; principle, procedure and applications: i) Simple staining ii) Differential staining-Grams and acid fast staining, iii) Structural staining- endospore, flagella, capsular and granular staining.	**6**

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

Textbooks:	
1	PelczarMJ,ChanECSandKreigNRTataMcGrowHill.
2	RCDubeyandDKMaheswari(2002).PracticalMicrobiology.S.ChandPublishing.
3	WilleyJ.,SherwoodL.,andWoolvertonC.J.,(2017).Prescott'sMicrobiology.10thEdition., McGraw-Hill International edition
4	Boyd,R.F.(1998).GeneralMicrobiology,2ndEdition.,TimesMirror,Mosby College Publishing, St Louis
5	Salle.A.J(1992).FundamentalPrinciplesofBacteriology.7thEdition.,McGraw Hill Inc.NewYork
ReferenceBooks:	
1	General Microbiology: RYStanier, Adelberg EA and JL Ingraham, MacMillan Press Inc.
2	Introduction to microbiology:Ingraham JL and Ingraham CAThomsonBrooks/Cole.
3	Principles of microbiology: RM Atlas Wm C brown Publishers.
4	Brock's biology of Microorganisms: Madigan MT and Martinko JM Pearson Education Inc
5	Willey, J., Sandman, K., & Wood, D. (2020). *Prescott's Microbiology* (11th ed.). McGraw-Hill Education.
Webresources:	
1	https://www.cliffsnotes.com/study-guides/biology/microbiology/introduction-tomicrobiology/a-brief-history-of-microbiology
2	https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6604941/#
3	https://www.keyence.com/ss/products/microscope/bz-x/study/principle/structure.jsp

4	https://bio.libretexts.org/@go/page/9188
5	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbialnutrition/

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	3	3	1	3	2	1	2	3	2	3	1
CO2	3	3	2	2	3	2	3	2	3	2	3
CO3	3	1	3	2	3	1	2	1	2	2	3
CO4	3	3	1	2	1	3	2	3	1	3	2
CO5	2	3	2	1	3	2	1	3	2	1	2
Total	14	13	09	10	12	09	10	12	10	11	11
Average	2.8	2.6	1.8	2.0	2.4	1.8	2.0	2.4	2.0	2.2	2.2

3–Strong, 2-Medium,1- Low

I[ST] YEAR SECOND SEMESTER

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UMBC21	**MICROBIAL PHYSIOLOGYAND METABOLISM**	Core CC-3	3	1	2	0	5	6	25	75	100

Learning Objectives	
LO1	To study the nutritional requirements of microorganisms and their transport mechanisms.
LO2	To study microbial growth influencing factors, and specialized growth patterns.
LO3	To explore key metabolic pathways and energy generation mechanisms in microorganisms.
LO4	To explore an aerobic respiration and fermentation pathways in microorganisms.
LO5	To study photosynthetic prokaryotes and bioluminescence.

Unit	Content	Hours
1	Microbial Nutrition and Transport Mechanisms: Nutritional requirements of Microorganisms- Autotrophs, Heterotrophs, Chemotrophs, Copiotrophs and Oligotrophs. Cell membrane–models, properties and functions. Transport Mechanisms- Diffusion-Facilitated Diffusion, Active transport- Group translocation.	18
2	Microbial Growth and Its Regulation: Definitions of growth–Effect of Environmental factors on growth – pH, temperature, oxygen, osmotic pressure-synchronous growth and continuous cultivation. Diauxic growth, Sporulation – Endospore formation in bacteria.	18
3	Microbial Metabolism and Energy Production: Metabolism - EMP, HMP, ED pathway, TCA cycle- Electron transport chain, Phosphorylation, Oxidative Phosphorylation, Substrate level Phosphorylation.	18
4	Anaerobic Respiration and Fermentation: Anaerobic respiration- sulphur, nitrogenous compounds and $C0_2$ as a final electron acceptor- Fermentation: Homolactic, heterolactic, alcoholic and mixed acid. Comparative study of aerobic vs anaerobic metabolism.	18
5	Microbial Photosynthesis: Photosynthesis in microorganisms–oxygenic photosynthesis, cyanobacteria structure and functions, light dependent reactions and calvincycle – an oxygenic photosysnthesis, purple and green photosynthetic bacteria, heliobacteria, chloroflexi and halophilic archaea.	18
	Total	90

CO	Course Out comes
CO1	Understand microbial nutritional classifications and transport processes.
CO2	Understand growth curves, environmental effects, and microbial growth strategies.
CO3	Understand microbial metabolic pathways and their role in energy production.
CO4	Understand electron acceptors in anaerobic respiration and different types of fermentation.

CO5	Understand oxygenic and an oxygenic photosynthesis and microbial light-based processes.

Textbooks:	
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	Meena Kumari. S. Microbial Physiology, Chennai 1st Edition MJP Publishers 2006.
4	Dubey R.C. and Maheswari, S. (2003). A textbook of Microbiology, NewDelhi: S. Chand&Co.
5	S.RamReddy, S.M.Reddy(2008).Microbial Physiology. Anmol PublicationsPvtLtd.

ReferenceBooks:

1	Robert K. Poole (2004).Advances in Microbial Physiology, Elsevier Academic Press, New York, Volume 49.
2	Kim B.H.,GaddG.M.(2008).Bacterial Physiology and Metabolism.Cambridge University Press, Cambridge
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, 3rdedition.Wiley–LISS,A John Wiley & Sons. Inc. Publications.
5	Bhanu Shrivastava.(2011). Microbial Physiology and Metabolism: Study of Microbial Physiology and Metabolism. Lambert academic Publication.
Web resources:	
1	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition
2	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
3	http://web.iitd.ac.in/~amittal/2007_Addy_Enzymes_Chapter.pdf
4	https://www.frontiersin.org/journals/microbiology/sections/microbial-physiology-and-metabolism

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PSO1**	**PSO2**	**PSO3**
CO1	3	3	2	2	2	2	3	3	3	2	3
CO2	3	2	2	3	2	2	2	3	1	3	2
CO3	3	3	2	1	2	2	2	3	3	1	3
CO4	2	3	2	3	2	2	2	2	3	3	2
CO5	3	2	2	3	3	2	3	3	3	3	2
Total	14	13	10	12	11	10	12	14	13	12	12
Average	2.8	2.6	2.0	2.4	2.2	2.0	2.4	2.8	2.6	2.4	2.4

3–Strong, 2-Medium,1- Low

Course Code	Course Name	Category	L	T	P	S	Credits	Hours	Marks		
									CIA	External	Total
25UMBC21P	**Practical II–Microbial Physiology and metabolism**	Core CC-4	0	0	3	0	2	3	25	75	100

Learning Objectives	
LO1	To learn techniques for observing microbial motility and staining methods for bacterial identification.
LO2	To understand methods for quantifying microorganisms using direct and viable counting techniques.
LO3	To understand an aerobic cultivation techniques and methods for assessing microbial Antibiotic susceptibility.
LO4	To examine the structural diversity of algae, fungi, and protozoa and learn micrometry Techniques for size measurement.
LO5	To study various bacterial identification methods and techniques for maintaining pure cultures.

Unit	Content	Hours
1	Microbial Motility and Staining Techniques: Motility demonstration: hanging drop, wet mount preparation, semi-solid agar. Staining techniques: Smear preparation, Capsular, and Acid-fast staining	09
2	Microbial Enumeration Techniques: spread plate–Direct cell count (Petroff-Hausser counting chamber), Turbidometry. Viable count - pour plate, spread plate.	09
3	Anaerobic Culture and Antibiotic Sensitivity Testing: Anaerobic culture methods – Candle jar method. Antibiotic sensitivity testing: Disc diffusion test.	09
4	Morphological Study of Microorganisms and Micrometry: Morphological variations in algae, fungi and protozoa. Micrometry.	09
5	Biochemical test and Culture Maintenance Techniques: IMViC test, H_2S, TSI, Oxidase, catalase, urease test and Carbohydrate fermentation test. Maintenance of pure culture, paraffin method, stab culture.	09
	Total	45

CO	Course Outcomes
CO1	Gain proficiency in motility assays and differential staining techniques.
CO2	Gain proficiency indirect cell counting,
CO3	Gain proficiency in anaerobic culture methods and antibiotic sensitivity testing using The disc diffusion method.
CO4	Understand morphological variations in microorganisms and accurately measure their Dimensions using micrometry.
CO5	Gain proficiency in morphological, physiological, and biochemical bacterial Identification and learn culture preservation methods.

Textbooks:	
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	SundararajT(2005). Microbiology Lab Manual(1st edition) publications.
4	Gunasekaran,P.(1996).Laboratory manual in Microbiology. New Age International Ld., Publishers, New Delhi.
5	RCDubeyandD K Maheswari (2002).Practical Microbiology.S.Chand Publishing.
ReferenceBooks:	
1	ElsaCooper(2018).Microbial Physiology: A Practical Approach.CallistoReference Publisher.
2	RobertK.Poole(2004).Advances in Microbial Physiology,Elsevier Academic Press, New York, Volume 49.
3	Dawes,I.W and Sutherland L.W(1992).Microbial Physiology(2ndedition),Oxford Blackwell Scientific Publications.
4	Lehninger, Principles of Biochemistry(IE) 7thEdition(2017)by DavidL.Nelson.
5	MadiganM.T.,MartinkoJ.M.,StahlD.A,andClarkD.P.(2010).Brock-Biologyof Microorganisms, 13th Edition Benjamin-Cummings Pub Co
6	Rajan, S and R. Selvi christy. 2015. Experimental procedures in Life Sciences. CBC Publishers and distributors Pvt Ltd.
Web resources:	
1	https://sites.google.com/site/bscmicrobiologycbcs/home/bacterial-physiology-metabolism
2	https://courses.lumenlearning.com/boundless-microbiology/chapter/microbial-Nutrition
3	https://onlinecourses.swayam2.ac.in/cec20_bt14/preview
4	https://www.studocu.com/in/search/Microbial%20physiology?origin=landing

Mapping with Programme Outcomes and Programme Specific Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PSO1	PSO2	PSO3
CO1	2	3	3	3	2	3	1	3	3	3	3
CO2	3	2	3	3	3	3	1	3	3	3	3
CO3	3	3	3	3	2	3	1	3	3	3	3
CO4	3	3	2	2	3	3	1	3	3	3	3
CO5	3	3	3	3	2	3	1	3	3	3	3
Total	14	14	14	14	12	15	5	15	15	15	15
Average	2.8	2.8	2.8	2.8	3	3	1	3	3	3	3

3–Strong, 2-Medium,1- Low

Subject Code	Subject Name	Category	L	T	P	S	Credits	Inst. Hours	Marks		
									CIA	External	Total
25UMBS21	**BIO INSTRUMENTATION**	Elective Generic /Discipline Specific Elective II	**1**	**0**	**1**	**0**	**2**	**2**	**25**	**75**	**100**

Course Objectives	
CO1	To introduce fundamental principles and application of instruments used in microbiological research
CO2	To gain knowledge about principles of spectroscopy
CO3	Understand the analytical techniques of Chromatography and electrophoresis
CO4	To understand the principle of different types of scans used in medical diagnosis
CO5	To gain information about the principles of radioactivity and its measurements

Unit	Details	No. of Hours
1	Basic instruments: Definition, scope and importance of bioinstrumentation in microbiology – Calibration of instrument – safety protocols and calibration – Analytical balance, autoclave, hot air oven, incubator, laminar air flow and pH meter.	09
2	Spectroscopic Techniques: Spectroscopic Techniques: Colorimeter, UV-Visible, fluorescence, IR.	09
3	Chromatographic and Electrophoresis Techniques: Chromatographic Techniques: Paper, Thin Layer, Column, HPLC and GC. Electrophoresis Techniques: Agarose and polyacrylamide gel electrophoresis, SDS-PAGE for protein analysis	09
4	Imaging techniques: Principle, Instrumentation and application of ECG, EEG, EMG, MRI, CT and PET scan radio isotopes.	09
5	Fluorescence and radiation based techniques: Spectrofluorometer, Flame photometer, Scintillation counter, Geiger Muller counter, Autoradiography.	09
	Total	45

Course Outcomes	
Course Outcomes	On completion of this course, students will;
CO1	Gain knowledge about the basics of instrumentation.
CO2	Exemplify the structure of atoms and molecules by using the Principles of spectroscopy.
CO3	Evaluate by separating and purifying the components.
CO4	Understand the need and applications of imaging techniques.
CO5	Categorize the working principle and applications of fluorescence and radiation.

Text Books	
1.	JayaramanJ(2011).LaboratoryManualinBiochemistry,2nd Edition.WileyEastern Ltd., New Delhi.
2.	Ponmurugan. P and Gangathara PB (2012).Biotechniques.1st Edition.MJPpublishers.
3	Veerakumari,L(2009).Bioinstrumentation-5th Edition-.MJPpublishers.
4	Upadhyay,UpadhyayandNath(2002).Biophysicalchemistry–Principlesand techniques3rd Edition.Himalayapublishinghome.
5	ChatwalGandAnand(1989).InstrumentalMethodsofChemicalAnalysis.S.Himalaya Publishing House, Mumbai.
References Books	
1	Rodney.F.Boyer(2000).ModernExperimentalBiochemistry,3rd Edition.Pearson Publication.
2	SkoogA.,West M (2014). Principles of Instrumental Analysis – 14th Edition W.B.Saunders Co.,Philadephia.
3	N.Gurumani.(2006).ResearchMethodologyforbiologicalsciences-1st Edition–MJP Publishers.
4	WilsonK,andWalkerJ(2010).PrinciplesandTechniquesofBiochemistryand MolecularBiology.7th Edition.CambridgeUniversityPress.
5	Webster,J.G.(2004).Bioinstrumentation-4th Edition-JohnWiley&Sons(Asia) Pvt.Ltd, Singapore.
Web Resources	
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-and-applications/
3	https://study.com/academy/lesson/what-is-chromatography-definition-typesuses.html
4	http://www.rsc.org/learn-chemistry/collections/spectroscopy/introduction

Mapping with Programme Outcomes:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11
CO1	3	3	2	3	3	3	2	3	2	3	1
CO2	3	3	3	2	3	3	3	2	3	2	3
CO3	3	1	2	3	3	3	2	3	2	2	3
CO4	3	3	2	3	3	3	2	3	1	3	2
CO5	3	3	1	2	3	2	1	2	2	1	2
Total	15	13	10	13	15	14	10	13	10	11	11
Average	3.0	2.6	2.0	2.6	3.0	2.8	2.0	2.6	2.0	2.2	2.2

3 – Strong, 2 - Medium, 1 – Low