SARDAR PATEL UNIVERSITY

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

Vallabh Vidyanagar

Gujarat

Academic Program Structure

&

Curriculum

(Aligned with NEP-2020)

[M.Sc. Microbiology]

NHEQF Level: 6.0/6.5

Entry NHEQF Level	:	5.5/6
Duration	:	Two Years (Four Semesters)
Total Courses	:	24
Total Learning Hours	:	2640
Total Credits	:	88
Total Marks	:	2200

M. Sc. Microbiology

Graduate Attributes (GAs):

Upon successful completion of the M.Sc in Microbiology programme, graduates are expected to attain the following Graduate Attributes:

GA1: **Advanced Knowledge of Microbiology**

Demonstrate an in-depth understanding of the fundamental concepts, principles, and theories in microbiology, including specialized areas such as microbial genetics, immunology, molecular biology and microbial biotechnology.

GA2: **Research Aptitude and Scientific Inquiry**

Develop hypothesis, design experiments, analyze, interpret, and draw logical conclusions from complex biological data.

GA3: **Advanced Technical and Laboratory Skills**

Develop proficiency in a range of modern microbiological and molecular biology techniques.

GA4: **Analytical and Critical Thinking Skills**

Apply their microbiological expertise to address real-world challenges in sectors like healthcare, pharmaceuticals, agriculture, food safety, and environmental management.

GA5: **Application of Knowledge and Problem-Solving**

Identify relevant research problems, formulate hypotheses, and design experiments to test them.

GA6: **Entrepreneurial Mindset and Employment Readiness**

Identify opportunities for innovation and enterprise in the microbiology sector. Insights in microbial product development life cycle.

GA7: **Communication and Collaboration Skills**

Communicate complex scientific information effectively and clearly to diverse audiences.

GA8: **Ethical, Constitutional, and Moral Values**

Practice science with integrity and a strong sense of professional ethics.

GA9: **Use of Modern Tools and Digital Technologies**

Utilize modern Information and Communication Technology (ICT) tools, AI/ML applications in microbiology, computational tools, and statistical software for data analysis, modeling biological systems, and managing scientific information.

GA10: **Sustainability and Environmental Awareness**

Understand the critical role of microorganisms in maintaining ecosystem balance and in addressing environmental challenges.

GA11 **Reflective Thinking and Lifelong Learning**

Acquire the capacity for metacognition and self-assessment, enabling them to identify their own learning needs.

GA12 **Global Citizenship and Holistic Development**

Engage with global scientific communities and contribute to international public health and food security initiatives.

These attributes ensure that the M.Sc. Microbiology program not only imparts advanced knowledge but also fosters holistic development, preparing graduates for meaningful contributions to science, industry, and society.

Programme Educational Outcomes (PEOs):

Within two years of the completion of the programme:

PEO1: Graduates will be able to critically comprehend and articulate the latest developments and emerging trends in the field.

PEO2: Graduates will apply critical thinking to evaluate scientific literature, experimental results, and methodologies, enabling them to troubleshoot experiments and assess the validity of scientific findings

PEO3: Graduates will develop innovative solutions for problems related to infectious diseases, antimicrobial resistance, and industrial fermentation

PEO4: Graduates will proficiently conduct literature reviews using scientific databases and understand the ethical considerations involved in biological research demonstrating their preparedness for pursuing doctoral studies or R&D careers.

PEO5: Graduates will understand the processes involved in commercializing biological products (e.g., probiotics, biofertilizers, diagnostic kits) and possess the employability skills required to secure positions in academic, industrial, or public health settings

PEO6: Graduates will be committed to upholding biosafety and bioethics standards, data integrity and responsible conduct of research, understanding the implications of genetic engineering and intellectual property rights. They will also be aware of their constitutional duties and demonstrate values that contribute to nation-building

PEO7: Graduates will apply microbiology skills and knowledge in achieving the Sustainable Development Goals (SDGs)

PEO8: Graduates will strive for continuous skill development (up-skilling and re-skilling) and self-directed learning to keep pace with the rapidly evolving scientific landscape

PEO9: Graduates will emerge as well-rounded individuals who integrate scientific knowledge with human values, demonstrating a commitment to social justice and environmental responsibility

M. Sc. Microbiology

Program Learning Outcomes (PLOs):

Upon successful completion of the programme, learner will be able to

PLO1: **Demonstrate** an advanced and integrated understanding of core concepts in molecular biology, microbial physiology, genetics, and biotechnology, **explaining** the molecular mechanisms underlying cellular processes.

PLO2: **Apply** the principles of enzymology, bioprocess technology, and genetic engineering to **solve** theoretical and practical problems related to industrial and environmental microbiology.

PLO3: **Analyze** and interprete complex microbiological and omics data using biostatistical tools, bioinformatics software, and spectroscopic methods to **identify** patterns, relationships, and significant findings.

PLO4: **Evaluate** scientific literature and experimental methodologies to **critique** research designs, **assess** the validity of conclusions, and **formulate** evidence-based arguments in specialized areas like food, dairy, and environmental microbiology.

PLO5: **Design** and **execute** experiments to investigate hypotheses in molecular biology, microbial ecology, and diagnostics, demonstrating proficiency in advanced microbiological techniques and adhering to biosafety protocols.

PLO6: **Articulate** research findings, scientific concepts, and project proposals through effective written reports and oral presentations to diverse professional and academic audiences.

PLO7: **Integrate** knowledge of microbial processes with principles of bioethics, IPR, and regulatory affairs to **propose** sustainable and ethically sound solutions for challenges in healthcare, agriculture, and the pharmaceutical industry.

PLO8: **Formulate** research questions and **develop** a systematic research methodology, including literature reviews and hypothesis testing, to address gaps in microbiological knowledge.

PLO9: **Select** and **utilize** modern ICT tools, computational resources, and databases for the management, analysis, and modeling of biological systems, demonstrating digital literacy essential for lifelong learning.

PLO10: **Differentiate** between various microbial interactions in natural and engineered systems and **appraise** the role of microorganisms in achieving sustainable development goals, including waste management and bioremediation.

PLO11: **Recognize** the principles of entrepreneurship and biomanufacturing to **identify** opportunities for commercializing microbiological innovations, such as probiotics, diagnostics, and biofertilizers.

PLO12: **Collaborate** in interdisciplinary teams and demonstrate leadership skills in effective management and **execution** of projects related to molecular therapeutics, diagnostics, or omics technologies, demonstrating professional conduct and a commitment to societal and environmental responsibility.

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[Master of Science in Microbiology]

Semester-I

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	P2S01NCMIC01	Molecular Biology	4-0-1	120	4	30	20	50	50	100
DSC	P2S01NCMIC02	Microbial Physiology and Metabolism	4-0-1	120	4	30	20	50	50	100
DSC	P2S01NCMIC03	Molecular Cell Biology	4-0-1	120	4	30	20	50	50	100
DSC	P2S01NCMIC04	Bioanalytical Laboratory	0-8-0	120	4	30	20	50	50	100
DSC	P2S01NCMIC05	Cellular and Molecular Biology Laboratory	0-8-0	120	4	30	20	50	50	100
DSE (Any One)	P2S01NEMIC01	Bioethics & Biosafety	2-0-0	60	2	15	10	25	25	50
	P2S01NEMIC02	Entrepreneurship Fundamentals	2-0-0							
	P2S01NEMIC03	Principles of Ecology	2-0-0							
	P2S01NEMIC04	Pharmaceutical Microbiology	1-2-0							
	P2S01NEMIC05	Mathematics Essentials for Biologists	2-0-0							
				660	**22**			275	275	550

DSC: Discipline Specific Core; **DSE**: Discipline Specific Elective; **L**: Lecture; **P**: Practical; **T**: Tutorial ; **FA:** Formative Assessment
SA: Summative Assessment

SARDAR PATEL UNIVERSITY

Vallabh Vidyanagar

NAAC 'A' Grade (10-01-2023 To 09-01-2028)

NEP-2020 aligned Curriculum with effect from Academic Year 2026-27

[Master of Science in Microbiology]

Semester-II

Course Type	Course Code	Course Title	Teaching-Learning Scheme		Credits	Assessment Scheme & Marks				
			L-P-T	Total Notional Hours		Internal Assessment			External Assessment	Total Marks
						FA	SA	Total		
DSC	P2S02NCMIC01	Microbial Genetics	4-0-1	120	4	30	20	50	50	100
DSC	P2S02NCMIC02	Enzyme Technology	4-0-1	120	4	30	20	50	50	100
DSC	P2S02NCMIC03	Cellular & Molecular Immunology	4-0-1	120	4	30	20	50	50	100
DSC	P2S02NCMIC04	Microbial Genetics and Immunology Laboratory	0-8-0	120	4	30	20	50	50	100
DSC	P2S02NCMIC05	Enzyme Technology Laboratory	0-8-0	120	4	30	20	50	50	100
DSE (Any one)	P2S02NEMIC01	Biostatistics Using R	2-0-0	60	2	15	10	25	25	50
	P2S02NEMIC02	Microtechniques	1-2-0							
	P2S02NEMIC03	Developmental Biology	2-0-0							
	P2S02NEMIC04	Molecular Endocrinology	2-0-0							
				660	**22**			275	275	550

DSC: Discipline Specific Core **DSE**: Discipline Specific Elective **L**: Lecture **P**: Practical **T**: Tutorial

FA: Formative Assessment **SA**: Summative Assessment