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. Bioinformatics

NHEQF Level: 6.5

Entry NHEQF Level	:	5.5/6
Duration	:	Two Years (Four Semesters)
Total Courses	:	24
Total Learning Hours	:	2400
Total Credits	:	88
Total Marks	:	2200

Graduate Attributes (GAs)

Upon successful completion of the programme, graduates are expected to attain the following Graduate Attributes:

GA1. Advanced Disciplinary Knowledge

Demonstrate comprehensive and critical understanding of bioinformatics concepts and apply this knowledge responsibly to solve complex biological problems.

GA2. Computational and Analytical Skills

Apply computational, statistical, and analytical techniques with accuracy and integrity to interpret biological data and support scientific decision-making.

GA3. Technical Proficiency

Demonstrate proficiency in bioinformatics tools, databases, and technologies while maintaining precision, adaptability, and ethical use of resources.

GA4. Critical Thinking and Problem Solving

Analyze complex bioinformatics challenges critically and develop evidence-based solutions using logical reasoning and innovative approaches.

GA5. Research and Innovation

Design and conduct research with scientific rigor, creativity, and ethical responsibility to contribute to advancements in bioinformatics and related fields.

GA6. Communication and Ethics

Communicate scientific information effectively while upholding professional ethics, integrity, and respect in diverse academic and professional environments.

GA7. Systems Biology Competence

Apply systems biology approaches to understand biological interactions and demonstrate responsibility in interpreting and utilizing complex biological systems.

GA8. Omics Technology Application

Utilize omics technologies with technical expertise and ethical awareness to address real-world biological and healthcare challenges.

GA9. Artificial Intelligence Integration

Integrate AI and machine learning techniques responsibly to enhance biological data analysis, prediction, and informed decision-making.

GA10. Big Data Interpretation

Manage and interpret large-scale biological datasets with accuracy, critical insight, and accountability in research and applied contexts.

GA11. Bioinformatics Tool Development

Design and develop bioinformatics tools and applications using programming skills, innovation, and adherence to best practices.

GA12. Interdisciplinary Collaboration

Collaborate effectively across disciplines with respect, adaptability, and shared responsibility to achieve innovative scientific outcomes.

GA13. Practical and Laboratory Skills

Demonstrate competence in laboratory and computational practices with precision, safety awareness, and commitment to quality outcomes.

Programme Educational Objectives (PEOs):

Within 2–3 years of completing the programme, graduates will be able to:

PEO1. Demonstrate advanced knowledge of bioinformatics concepts to address complex problems in genomics, proteomics, and computational biology.

PEO2. Apply bioinformatics tools, databases, and computational techniques to analyze, interpret, and manage biological data in research and industry.

PEO3. Analyse biological datasets using statistical, computational, and algorithmic approaches to support scientific discovery and decision-making.

PEO4. Design and develop bioinformatics solutions, models, and applications to address challenges in healthcare, drug discovery, and biotechnology.

PEO5. Evaluate emerging technologies, tools, and methodologies in bioinformatics to improve efficiency and innovation in biological research.

PEO6. Conduct independent and collaborative research with scientific rigor to contribute to advancements in life sciences and biomedical fields.

PEO7. Apply interdisciplinary knowledge integrating biology, computer science, and data analytics to solve real-world biological problems.

PEO8. Demonstrate effective communication, teamwork, and leadership skills in professional, academic, and research environments.

PEO9. Evaluate ethical, legal, and social implications of bioinformatics practices and demonstrate responsibility in handling biological data.

PEO10. Apply lifelong learning strategies and adapt to evolving technologies to sustain professional growth in bioinformatics and related domains.

Program Learning Outcomes (PLOs):

Upon successful completion of the programme, learners will be able to:

PLO1. Demonstrate comprehensive knowledge of bioinformatics, including molecular biology, genetics, computational biology, and data analysis principles.

PLO2. Apply bioinformatics tools, databases, and computational techniques to analyze biological data in genomics, proteomics, and related fields.

PLO3. Analyse biological sequences, structures, and datasets using algorithms and software for accurate interpretation and prediction.

PLO4. Apply statistical and mathematical methods to interpret biological data and support research and clinical decision-making.

PLO5. Design bioinformatics workflows, pipelines, and models to solve complex biological and biomedical problems.

PLO6. Conduct independent and collaborative research using bioinformatics approaches, ensuring scientific rigor and reproducibility.

PLO7. Analyse biological systems using systems biology approaches, including pathway analysis and network modeling.

PLO8. Apply programming skills and computational techniques to develop bioinformatics tools and applications.

PLO9. Evaluate bioinformatics methods, technologies, and research findings for their effectiveness, reliability, and applicability.

PLO10. Demonstrate effective scientific communication skills through reports, presentations, and professional interactions.

PLO11. Apply ethical principles and professional responsibility in bioinformatics research, data handling, and technology use.

PLO12. Demonstrate interdisciplinary collaboration and adaptability by integrating knowledge from life sciences, computing, and data science.

Program Learning Outcomes (PLOs):

PLO1. Apply computational tools, algorithms, and bioinformatics databases to analyse and interpret genomic, proteomic, and other biological datasets.

PLO2. Develop and implement bioinformatics pipelines and software solutions using programming and data analysis techniques for biological research.

PLO3. Conduct integrative bioinformatics research combining molecular biology, statistics, and computational approaches to address complex problems in healthcare and biotechnology.

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

M.Sc. Bioinformatics

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	P2T01NCBIF01	Molecular Biology	4-0-1	120	4	20	30	50	50	100
DSC	P2T01NCBIF02	Biocomputing Fundamentals	4-0-1	120	4	20	30	50	50	100
DSC	P2T01NCBIF03	IT Fundamentals	4-0-1	120	4	20	30	50	50	100
DSC	P2T01NCBIF04	Practical's based on Molecular Biology and Biocomputing	0-8-0	120	4	20	30	50	50	100
DSC	P2T01NCBIF05	Practical's based on IT and Cell biology	0-8-0	120	4	20	30	50	50	100
DSC	P2T01NCBIF06	Fundamentals of Cell Biology	2-0-1	60	2	10	15	25	25	50
				660	22					**550**

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

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

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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	**P2T02NCBIF01**	Genetic Engineering	4-0-1	120	4	20	30	50	50	100
DSC	**P2T02NCBIF02**	Mathematics and Biostatistics	4-0-1	120	4	20	30	50	50	100
DSC	**P2T02NCBIF03**	Web Application Development in Bioinformatics	4-0-1	120	4	20	30	50	50	100
DSC	**P2T02NCBIF04**	Practical's based on Genetic Engineering and Mathematics and Biostatistics	0-8-0	120	4	20	30	50	50	100
DSC	**P2T02NCBIF05**	Practical's based on Web Application in Bioinformatics and Databases in Bioinformatics	0-8-0	120	4	20	30	50	50	100
DSC	**P2T02NCBIF06**	Databases in Life Sciences	2-0-1	60	2	10	15	25	25	50
				660	22					**550**

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