Re-Accredited 'B++' 2.86 CGPA by NAAC
VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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ક્રમાંકઃઓથો./પરિપત્ર/૧૩૬૪૨/૨૦૨૬
તા.૧૯/૦૬/૨૦૨૬

પ્રતિ,
વડાશ્રી,
બાયોટેકનોલોજી ડિપાર્ટમેન્ટ,
વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી,
સુરત.

વિષયઃ– NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭ થી અમલમાં આવનાર 2 Year PG- M.Sc. Biotechnology Semester-I/VII & II/VIII ના અભ્યાસક્રમ બાબત.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭ થી અમલમાં આવનાર 2 Year PG - M.Sc. Biotechnology Semester-I/VII & II/VIII નો પેટાસમિતિ દ્વારા તૈયાર કરેલ અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૨/૦૪/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૩ થી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૦૪/૬/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૧૫ થી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૧૮/૦૬/૨૦૨૬ની સભાના ઠરાવ ક્રમાંકઃ૧૩ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવશ્રી

પ્રતિ,
(૧) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા,
(૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....જાણ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Department of Biotechnology, VNSGU, Surat
TEACHING & EVALAUTION SCHEME (As per NEP 2020)
Programme Name: Undergraduate Program in Biotechnology (B. Sc. Biotechnology - Semester - VII) With Research/OJT

Structure																	
Course Category	**Course Code**	**Course Title**	**Mark Sheet Title in English**	**Level of Course**	**Teaching Hours/Week**		**Exam Duration (Hours)**		**Credit**		**Internal Marks**		**External Marks**		**Total**	
					TH	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**
Bachelor of Science	BT-MJ-701	Genomics and Proteomics	Genomics and Proteomics	400-499	2		1		2		25		25		50	
	BTP-MJ-701	Genomics and Proteomics: Practical	Genomics and Proteomics: Practical			4		6		2		25		25		50
	BT-MJ-702	Industrial Fermentation Technology	Industrial Fermentation Technology		2		1		2		25		25		50	
	BTP-MJ-702	Industrial Fermentation Technology: Practical	Industrial Fermentation Technology: Practical			4		6		2		25		25		50
	BT-MJ-703	GMP, Quality Control & Validation	GMP, Quality Control & Validation		2		1		2		25		25		50	
	BTP-MJ-703	GMP, Quality Control & Validation: Practical	GMP, Quality Control & Validation: Practical			4		6		2		25		25		50
	BT-ME-701	Sustainable Development Goals in Biotechnology	Sustainable Development Goals in Biotechnology		2		1		2		25		25		50	
	BTP-ME-701	Sustainable Development Goals in Biotechnology: Practical	Sustainable Development Goals in Biotechnology: Practical			4		6		2		25		25		50
	OR				OR											
	ME	Fundamentals of Cyber Security	Fundamentals of Cyber Security		4		2		4		50		50		100	
	BT-RP-01	Research Project / On-the-Job Training (OJT)	Research Project / On-the-Job Training (OJT)			12				6		75		75		150

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Department of Biotechnology, VNSGU, Surat
TEACHING & EVALAUTION SCHEME (As per NEP 2020)
Programme Name: Undergraduate Program in Biotechnology (B. Sc. Biotechnology - Semester - VII) Without Research/OJT

Structure																	
Course Category	**Course Code**	**Course Title**	**Mark Sheet Title in English**	**Level of Course**	**Teaching Hours/Week**		**Exam Duration (Hours)**		**Credit**		**Internal Marks**		**External Marks**		**Total**	
					TH	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**
Bachelor of Science	BT-MJ-701	Genomics and Proteomics	Genomics and Proteomics	400-499	2		1		2		25		25		50	
	BTP-MJ-701	Genomics and Proteomics: Practical	Genomics and Proteomics: Practical			4		6		2		25		25		50
	BT-MJ-702	Industrial Fermentation Technology	Industrial Fermentation Technology		2		1		2		25		25		50	
	BTP-MJ-702	Industrial Fermentation Technology: Practical	Industrial Fermentation Technology: Practical			4		6		2		25		25		50
	BT-MJ-703	GMP, Quality Control & Validation	GMP, Quality Control & Validation		2		1		2		25		25		50	
	BTP-MJ-703	GMP, Quality Control & Validation: Practical	GMP, Quality Control & Validation: Practical			4		6		2		25		25		50
	BT-MJ-704	Entrepreneurship in Rural Economy	Entrepreneurship in Rural Economy		4		2		4		50		50		100	
	OR				OR											
	BT-MJ-705	IPR, Bioethics and Biosafety	IPR, Bioethics and Biosafety		4		2		4		50		50		100	
	BT-ME-701	Sustainable Development Goals in Biotechnology	Sustainable Development Goals in Biotechnology		2		1		2		25		25		50	
	BTP-ME-701	Sustainable Development Goals in Biotechnology: Practical	Sustainable Development Goals in Biotechnology: Practical			4		6		2		25		25		50
	OR				OR											
	ME	Fundamentals of Cyber Security	Fundamentals of Cyber Security		4		2		4		50		50		100	
	MJ-UGRM0107	Research Methodology-I	Research Methodology-I		2		1		2		25		25		50	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Department of Biotechnology, VNSGU, Surat
TEACHING & EVALAUTION SCHEME (As per NEP 2020)
Programme Name: Undergraduate Program in Biotechnology (B. Sc. Biotechnology - Semester - VIII) With Research/OJT

Structure																	
Course Category	**Course Code**	**Course Title**	**Mark Sheet Title in English**	**Level of Course**	**Teaching Hours/Week**		**Exam Duration (Hours)**		**Credit**		**Internal Marks**		**External Marks**		**Total**	
					TH	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**
Bachelor of Science	BT-MJ-801	Advanced Molecular Techniques	Advanced Molecular Techniques	400-499	2		1		2		25		25		50	
	BTP-MJ-801	Advanced Molecular Techniques: Practical	Advanced Molecular Techniques: Practical			4		6		2		25		25		50
	BT-MJ-802	Bioinformatics and Data Sciences	Bioinformatics and Data Sciences		2		1		2		25		25		50	
	BTP-MJ-802	Bioinformatics and Data Sciences: Practical	Bioinformatics and Data Sciences: Practical			4		6		2		25		25		50
	BT-MJ-803	Entrepreneurship in Life Science	Entrepreneurship in Life Science		2		1		2		25		25		50	
	BTP-MJ-803	Entrepreneurship in Life Science: Practical	Entrepreneurship in Life Science: Practical			4		6		2		25		25		50
	BT-ME-801	Nanotechnology	Nanotechnology		2		1		2		25		25		50	
	BTP-ME-801	Nanotechnology: Practical	Nanotechnology: Practical			4		6		2		25		25		50
	OR				OR											
	ME	Entrepreneurship	Entrepreneurship		4		2		4		50		50		100	
	BT-RP-02	Research Project / On-the-Job Training (OJT)	Research Project / On-the-Job Training (OJT)			12				6		75		75		150

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Department of Biotechnology, VNSGU, Surat
TEACHING & EVALAUTION SCHEME (As per NEP 2020)
Programme Name: Undergraduate Program in Biotechnology (B. Sc. Biotechnology - Semester - VIII) Without Research/OJT

Structure																	
Course Category	**Course Code**	**Course Title**	**Mark Sheet Title in English**	**Level of Course**	**Teaching Hours/Week**		**Exam Duration (Hours)**		**Credit**		**Internal Marks**		**External Marks**		**Total**	
					TH	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**	**TH**	**PR**
Bachelor of Science	BT-MJ-801	Advanced Molecular Techniques	Advanced Molecular Techniques	400-499	2		1		2		25		25		50	
	BTP-MJ-801	Advanced Molecular Techniques: Practical	Advanced Molecular Techniques: Practical			4		6		2		25		25		50
	BT-MJ-802	Bioinformatics and Data Sciences	Bioinformatics and Data Sciences		2		1		2		25		25		50	
	BTP-MJ-802	Bioinformatics and Data Sciences: Practical	Bioinformatics and Data Sciences: Practical			4		6		2		25		25		50
	BT-MJ-803	Entrepreneurship in Life Science	Entrepreneurship in Life Science		2		1		2		25		25		50	
	BTP-MJ-803	Entrepreneurship in Life Science: Practical	Entrepreneurship in Life Science: Practical			4		6		2		25		25		50
	BT-MJ-804	Synthetic Biology	Synthetic Biology		4		2		4		50		50		100	
	BT-ME-801	Nanotechnology	Nanotechnology		2		1		2		25		25		50	
	BTP-ME-801	Nanotechnology: Practical	Nanotechnology: Practical			4		6		2		25		25		50
	OR				OR											
	ME	Entrepreneurship	Entrepreneurship		4		2		4		50		50		100	
	MJ-UGRM02028	Research Methodology - II	Research Methodology - II		2		1		2		25		25		50	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Postgraduate Program

In

Biotechnology

Pathways: Only Research / Only Course Work / Research and Course Work

[One Year (UG 4 + PG 1**) & Two Years (**UG 3 + PG 2**)]**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Postgraduate Program in Biotechnology

Teaching & Evaluation Scheme:
M. Sc. Biotechnology Semester-I/VII

[Academic Year of Implementation 2026-2027]

Semester-I/VII

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
BT-1001	Genomics and Proteomics	2	1:00	25	25	50	2
BTP-1001	Genomics and Proteomics: Practical	4	4:00 to 6:00	25	25	50	2
BT-1002	Industrial Fermentation Technology	2	1:00	25	25	50	2
BTP-1002	Industrial Fermentation Technology: Practical	4	4:00 to 6:00	25	25	50	2
BT-1003	GMP, Quality Control & Validation	2	1:00	25	25	50	2
BTP-1003	GMP, Quality Control & Validation: Practical	4	4:00 to 6:00	25	25	50	2
BT-1004	Indian Fermented Foods (BKS)	2	1:00	25	25	50	2
BTP-1004	Indian Fermented Foods (BKS): Practical	4	4:00 to 6:00	25	25	50	2
BT-1005	Fundamentals of Cyber Security	4	4:00	50	50	100	4
BT-1006	Research Methodology-I	2	1:00	25	25	50	2
Total		**30**	**--**	**275**	**275**	**550**	**22**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-1001
Course Level	500-599
Course Title	Genomics and Proteomics
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Principle and scope of genomics, Genome sequencing strategies, functional genomics approaches, Gene silencing and evaluation of ethical, legal, and social implications of Human Genome Project. **CO2:** Techniques for protein identification and characterization, analyze omics data for biological problem-solving including structural analysis of proteins.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content	**UNIT – 1: Mapping & Sequencing of Genomes** History & Scope of Genomics, Genetic and Physical Mapping, DNA sequencing (Sanger and Pyrosequencing), Analysis of DNA sequences, Assembling and Annotation of Genome sequences, Functional Genomics, Gene silencing, Human Genome Project, Ethical, Legal & Social Implications of Human Genome.	Teaching Hours: 15
	UNIT – 2: Expression Analysis & Characterization of Proteins Introduction, Protein Separation Techniques (2D Gel Electrophoresis, RPLC, HPLC), Protein Characterization (Mass Spectrometry, MALDI) Protein Microarrays, Structural Proteomics (X-ray Crystallography & NMR)	Teaching Hours: 15

Reference Books	• Peter J. Russell – iGenetics A Molecular Approach, 3rd Edition, Pearson Education, 2010 • S. B. Primrose and R.M. Twyman - Principles of Genome Analysis and Genomics, 7th Edition, Blackwell Publishing, 2006. • T. A. Brown – Genomes 4, Garland Science, Taylor & Francis Group

	• T. A. Brown – Gene Cloning and DNA Analysis - An Introduction, 7th edition, WILEY Blackwell • Snustad &Simmons- Principles of Genetics, 6th Edition, WILEY
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-1001
Course Level	500-599
Course Title	Genomics and Proteomics: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: To learn how Basic Mapping technique, DNA extraction from model organism, preparation of SDS Gel, isolation of proteins from plants, SDS-PAGE with isolated proteins, Different Staining Techniques (Coomassie brilliant blue & Silver Staining)

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

Course Content

1. To study Partial Restriction Digestion for Restriction Mapping.
2. To study the extraction of DNA from Yeast (*Saccharomyces cerevisiae*)
3. To study the isolation of total proteins from plants.
4. To study the gel preparation for SDS-PAGE.
5. To study the protein profiling by SDS-PAGE with different staining techniques (Coomassie brilliant blue & Silver Staining)

Teaching Hours: 60

Reference Books

- Sambrook & Russell (3rd ed.). (1989). Molecular Cloning: A Laboratory Manual (Vols. 1to3). Cold Spring Harbor Laboratory Press
- T. Devasena, (2010); Enzymology; OXFORD University Press
- Arti Nigam & Archana Ayyagari Lab Manual in Biochemistry, Immunology and Biotechnology Tata McGraw-Hill

Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-1002
Course Level	500-599
Course Title	Industrial and Fermentation Technology
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Apply core principles of bioprocess engineering to analyse bioreactor systems, microbial growth kinetics, fluid rheology, oxygen transfer phenomena, and statistical methods for media optimization in batch and continuous fermentation processes. **CO2:** Students will learn, how metabolic pathways are discovered and manipulated, to produce desired metabolite, at industrial level.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content

UNIT – 1: Bioprocess Engineering Bioreactors and types of bioreactors, Monod equation, Batch culture, and continuous culture. Fluid Rheology (Reynolds number, flow regimes, Power number (Np)), Oxygen transfer (OTR, OUR, kLa), Media optimization (Placket Burman, Response surface methodology).	Teaching Hours: 15
UNIT – 2: Metabolic Control and Strain Improvement Methods for decoding metabolic pathways, Feedback inhibition and its types, feedback repression, Mutants which do not produce feedback inhibitors or repressors, Mutants that do not recognize presence of inhibitors or repressors, use of auxotroph for production of primary metabolites.	Teaching Hours: 15

Reference Books	• Stanbury, P. F., Whitaker, A., & Hall, S. J. (2016). Principles of fermentation technology (3rd ed.). Elsevier. • Crueger, W., & Crueger, A. (1990). A textbook of industrial microbiology (2nd ed.). Sinauer Associates. • Doran, P. M. (2013). Bioprocess engineering principles (2nd ed.). Academic Press.

	• Nelson, D. L., & Cox, M. M. (2021). Lehninger Principles of Biochemistry (8^{th} ed.). • Montgomery, D. C. (2017). Design and analysis of experiments (9^{th} ed.). John Wiley & Sons
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-1002
Course Level	500-599
Course Title	Industrial and Fermentation Technology: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: Throughout the course, students will gain hands-on experience in bioprocess engineering by using statistical tools like Plackett–Burman and Response Surface Methodology to optimize yeast growth media. They will learn to measure and analyze Oxygen Transfer Rates (OTR) to ensure efficient aerobic fermentation and will study microbial kinetics by applying the Monod equation to growth curves. Additionally, students will design and operate both batch and continuous immobilized enzyme bioreactors, comparing their productivity and stability across different systems.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO									

Course Content

1. Screening of Variables for growth media of yeast using Placket Burman method.
2. Use of Response surface methodology for media optimization (for yeast)
3. Determination of Oxygen transfer rate (OTR) by sulphite oxidation method
4. Determination of factors affecting OTR
5. Construct Growth curve and Derive Monod equation (using Yeast)
6. Construction of Immobilized Invertase Enzyme bioreactor (Batch and continuous)

Teaching Hours: 60

Reference Books	• Stanbury, P. F., Whitaker, A., & Hall, S. J. (2016). Principles of fermentation technology (3rd ed.). Elsevier. • Crueger, W., & Crueger, A. (1990). A textbook of industrial microbiology (2nd ed.). Sinauer Associates. • Doran, P. M. (2013). Bioprocess engineering principles (2nd ed.). Academic Press. • Nelson, D. L., & Cox, M. M. (2021). Lehninger principles of biochemistry (8th ed.). W. H. Freeman. • Montgomery, D. C. (2017). Design and analysis of experiments (9th ed.). John Wiley & Sons • Suresh, S., Srivastava, V. C., & Mishra, I. M. (2009). Techniques for oxygen transfer measurement in bioreactors: A review. Chemical Engineering Journal, 152(2–3), 473–489. • Yang, Y., Deinstadt, M., & Eppendorf SE. (2018). Measuring the oxygen transfer rate (OTR) of fermentation bioreactors using the sulfite oxidation method. Eppendorf Bioprocess Center. • Monod, J. (1949). The growth of bacterial cultures. Annual Review of Microbiology, 3, 371–394. • Brena, B. M., & Batista-Viera, F. (2006). Immobilization of enzymes: A literature survey. Methods in Biotechnology, 22, 15–30. • Ross, D., Karimi, I. A., & Pandey, A. (2022). Bioprocess engineering principles (2nd ed.). Elsevier.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability
Subject Type	Discipline Specific Course
Course Code	BT-1003
Course Level	500-599
Course Title	GMP, Quality Control & Validation
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** The student will learn the concept, evolution, objectives, and scope of Good Manufacturing Practices (GMP) and their importance in pharmaceutical, biotechnology, and food product industries. The student will understand the GMP regulatory frameworks of WHO, FDA, BIS, and ISO, and the role of organization, personnel, and training in maintaining quality systems. **CO2:** The student will understand the principles of validation and qualification, including types of validation, analytical method validation, and cleaning validation, in compliance with regulatory guidelines. The student will understand and demonstrate the process validation lifecycle, including documentation systems, deviation handling, complaints, recalls, and preparation of validation reports to support continuous quality improvement.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content	**UNIT – 1: GMP Manufacturing Practices and Quality Control** Concept and Evolution of GMP, Objectives and Scope of GMP (Pharmaceutical, Biotechnology, Food Products), Importance of GMP and consequences of non-compliance, GMP Regulatory Frameworks (WHO, FDA 21 CFR 210 & 211, BIS, ISO 9001 & ISO 22000), Quality Management Systems and Quality Assurance overview, Organization & Personnel (roles, responsibilities, training and competency), Premises and Facility design, Layout and workflow, Environmental Controls (HVAC, cleanrooms and monitoring), Equipment Qualification concepts (DQ, IQ, OQ, PQ) and maintenance, Calibration and logbooks, Raw & Packaging Material Control (receipt, sampling, storage, release and traceability), Documentation Systems (SOPs, Batch Records, Change Control), Sanitation, Hygiene and Contamination Control, Deviations, CAPA, Complaints handling and Product Recalls.	Teaching Hours: 15

	UNIT – 2: Process Validation Quality Control Concepts & Objectives, Sampling Techniques, Specifications and basic statistical aspects, In-Process and Finished Product Quality Control, Analytical QC parameters (Accuracy, Precision, Specificity, Linearity, Range, Robustness, Solution Stability, LOD and LOQ), Handling of Out-of-Specification (OOS) results, Introduction to Validation and Qualification, Types of Validation (Process, Cleaning and Analytical Method Validation), Analytical Method Validation Parameters and Acceptance Criteria, Cleaning Validation Principles and Approaches, Process Validation Lifecycle (Process Design, Process Qualification, Continued Process Verification), Validation Master Plan (VMP), Documentation, Preparation of Validation Reports, Continuous Quality Improvement and Management Review.	Teaching Hours: 15
Reference Books	• WHO Good Manufacturing Practices – TRS 986 Annex 2: https://www.who.int/publications/m/item/trs986-annex2 • FDA Process Validation: General Principles and Practices: https://www.fda.gov/regulatory-information/search-fda-guidance-documents/process-validation-general-principles-and-practices • ICH Validation of Analytical Procedures (Q2(R1)): https://www.gmp-compliance.org/files/guidemgr/Q2(R1).pdf • WHO GMP Validation Guidelines – Annex 3 TRS 1019: https://www.who.int/docs/default-source/medicines/norms-and-standards/guidelines/production/trs1019-annex3-gmp-validation.pdf • FDA cGMP regulations (21 CFR Part 210/211) – https://www.ecfr.gov/current/title-21/chapter-I/subchapter-C/part-211	
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments	
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-1003
Course Level	500-599
Course Title	GMP, Quality Control & Validation: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: The student will learn and prepare GMP-compliant documentation such as Standard Operating Procedures (SOPs), demonstrate the principles of GMP facility layout, material and personnel flow, sanitation, hygiene, and contamination control through case studies and laboratory observations. The student will perform and document equipment calibration and qualification activities (IQ, OQ, PQ) for commonly used laboratory instruments to ensure reliability and accuracy. The student will learn and apply quality control techniques, The student will understand and prepare validation protocols and reports, including analytical method validation and cleaning validation, using experimental or model data.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

Course Content	1. Prepare a Report on Standard Operating Procedures (SOPs) for any Pharmaceutical/Biotechnology/Food product. 2. Case study of GMP outline of any reputed company. 3. Equipment Calibration and Report Documentation at your institute level 4. Labelling, Storage and Traceability according to QC Guidelines. 5. Prepare Report on: Validation Mock report.	Teaching Hours: 60
Reference Books	• World Health Organization (WHO). Good Manufacturing Practices for Pharmaceutical Products (TRS 986, Annex https://www.who.int/publications/m/item/trs986-annex2 • World Health Organization (WHO). Guidelines on Validation – GMP (TRS 1019, Annex 3). https://www.who.int/docs/default-source/medicines/norms-and-standards/guidelines/production/trs1019-annex3-gmp-validation.pdf	

	• U.S. Food and Drug Administration (FDA). Process Validation: General Principles and Practices. https://www.fda.gov/files/drugs/published/Process-Validation--General-Principles-and-Practices.pdf • U.S. Food and Drug Administration (FDA). Current Good Manufacturing Practice (cGMP) Regulations – 21 CFR Parts 210 & 211. https://www.ecfr.gov/current/title-21/chapter-I/subchapter-C • International Council for Harmonisation (ICH). Q2(R1): Validation of Analytical Procedures – Text and Methodology. https://www.fda.gov/media/152208/download • European Commission. EudraLex Volume 4 – EU Guidelines for Good Manufacturing Practice. https://health.ec.europa.eu/medicinal-products/eudralex/eudralex-volume-4_en
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability
Subject Type	Intra-disciplinary
Course Code	BT-1004
Course Level	500-599
Course Title	Indian Fermented Foods (BKS)
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Students will be able to explain the principles of fermentation, identify major microorganisms involved and describe the diversity and nutritional significance of Indian fermented foods. (Bloom's Level: Understand and Apply) **CO2:** Students will be able to analyze the functional, health, safety, and industrial aspects of fermented foods and evaluate their role in probiotic applications and entrepreneurship opportunities. (Bloom's Level: Analyse and Evaluate)

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1	■	■		■		■		
CO2	■	■		■	■	■	■	

Course Content

UNIT – 1: Microbiology and Diversity of Indian Fermented Foods

-Fundamentals of Fermentation: Definition, History and importance of food fermentation; Types of fermentation: Lactic acid and Alcoholic fermentation; Role of fermentation in food preservation and nutrition

-Microorganisms in Fermented Foods: Major groups: Lactic acid bacteria (*Lactobacillus*, *Leuconostoc*)**,** Yeasts (*Saccharomyces cerevisiae*)**,** Molds (*Aspergillus*, *Rhizopus*)**;** Natural fermentation and starter cultures; Factors influencing fermentation: Temperature, pH, Substrate.

-Major Indian Fermented Foods: Microorganisms, substrate and significance of: Milk-based: Curd, buttermilk; Cereal-based: Idli, Dosa, Dhokla, Jalebi; Vegetable-based: Pickles, Kanji; Traditional ethnic fermented foods (overview)

-Nutritional Changes During Fermentation: Improvement in digestibility**;** Vitamin synthesis (B-complex)**;** Reduction of anti-nutritional factors

Teaching Hours: 15

	UNIT – 2: Health, Safety and Applications of Fermented Foods -Functional and Probiotic Properties: Concept of probiotics**;** Role of fermented foods in gut health**;** Major probiotic microorganisms -Health Benefits of Fermented Foods: Role in prevention of: Gastrointestinal disorders**,** Diabetes and obesity**,** cardiovascular diseases (Basic mechanism overview) -Food Safety and Quality: Beneficial *Vs* harmful microorganisms**;** Importance of hygienic preparation**;** Role of starter cultures -Industrial and Entrepreneurship Aspects: Commercial production of fermented foods**;** Starter cultures and fermented food industry in India**;** Scope of fermented foods in food biotechnology and Start-ups	Teaching Hours: 15
Reference Books	• Adams, M. R. and Moss, M.O., Food Microbiology, Royal Society of Chemistry. • Hutkins, R. W. Microbiology and Technology of Fermented Foods, Wiley-Blackwell. • Tamang, J. P., Ethnic Fermented Foods and Alcoholic Beverages of Asia, Springer. • Steinkraus, K.H., Handbook of Indigenous Fermented Foods, CRC Press. • Ray, B. and Bhunia, A., Fundamental Food Microbiology, CRC Press. • FAO. Fermented Fruits and Vegetables: A Global Perspective.	
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments	
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	I/VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability, Skill Development and Entrepreneurship
Subject Type	Discipline Specific
Course Code	BT-1004
Course Level	500-599
Course Title	Indian Fermented Foods (BKS): Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: Students will be able to understand the microbiological, nutritional, health, safety and industrial aspects of Indian fermented foods and apply fermentation knowledge in food biotechnology, probiotic applications and entrepreneurship development.
Mapping between Cos and PSOs	<table><tr><td></td><td>PSO1</td><td>PSO2</td><td>PSO3</td><td>PSO4</td><td>PSO5</td><td>PSO6</td><td>PSO7</td><td>PSO8</td></tr><tr><td>CO</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Course Content	1. Preparation of traditional fermented foods (Curd, Idli/Dosa batter, Dhokla, Kanji). 2. Isolation and purification of microorganisms from fermented food samples. 3. Microscopic examination and Gram staining of fermentative microorganisms. 4. Determination of pH changes during fermentation process. 5. Estimation of microbial load in fermented foods by serial dilution and plate count method. 6. Comparative study of natural fermentation and starter culture fermentation. 7. Screening of fermented food microorganisms for probiotic properties. 8. Food safety and quality assessment of fermented food products.	Teaching Hours: 60

Reference Books	• Cappuccino, J. G. and Welsh, C. T., Microbiology: A Laboratory Manual, Pearson Education. • Aneja, K. R., Experiments in Microbiology, Plant Pathology and Biotechnology, New Age International Publishers. • Frazier, W. C. and Westhoff, D. C., Food Microbiology, Tata McGraw-Hill. • Adams, M. R. and Moss, M. O., Food Microbiology, Royal Society of Chemistry. • Harrigan, W. F., Laboratory Methods in Food Microbiology, Academic Press. • Hutkins, R. W., Microbiology and Technology of Fermented Foods, Wiley-Blackwell. • Tamang, J. P., Ethnic Fermented Foods and Alcoholic Beverages of Asia, Springer. • Ray, B. and Bhunia, A., Fundamental Food Microbiology, CRC Press. • Seeley, H. W. and VanDemark, P. J., Microbes in Action: A Laboratory Manual of Microbiology, Freeman Publications. • Indian Council of Agricultural Research (ICAR), Laboratory Manuals in Food Microbiology and Fermentation Technology.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Postgraduate Program in Biotechnology

Teaching & Evaluation Scheme:
M. Sc. Biotechnology Semester-II/VIII

[Academic Year of Implementation 2026-2027]

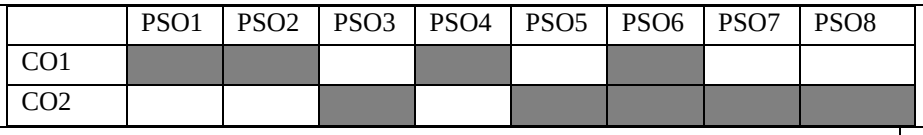
Semester-II/VIII

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
BT-2001	Advanced Molecular Techniques	2	1:00	25	25	50	2
BTP-2001	Advanced Molecular Techniques: Practical	4	4:00 to 6:00	25	25	50	2
BT-2002	Bioinformatics and Data Sciences	2	1:00	25	25	50	2
BTP-2002	Bioinformatics and Data Sciences: Practical	4	4:00 to 6:00	25	25	50	2
BT-2003	Entrepreneurship in Life Science	2	1:00	25	25	50	2
BTP-2003	Entrepreneurship in Life Science: Practical	4	4:00 to 6:00	25	25	50	2
BT-2004	Aquaculture (Vocational Course)	2	1:00	25	25	50	2
BTP-2004	Aquaculture: Practical	4	4:00 to 6:00	25	25	50	2
BT-2005	Entrepreneurship	4	4:00	50	50	100	4
BT-2006	Research Methodology-II	2	1:00	25	25	50	2
Total		**36/34**	**--**	**275**	**275**	**550**	**22**

[Subject code-2703083302011001]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BT-2001
Course Level	500-599
Course Title	Advanced Molecular Techniques
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	**CO1:** Explain and apply the principles of advanced protein and nucleic acid techniques, including Western blotting, affinity purification, flow cytometry, hybridization, and isothermal amplification, in biotechnology applications. **CO2:** Explain and apply the principles of advanced protein and nucleic acid techniques, including Western blotting, affinity purification, flow cytometry, hybridization, and isothermal amplification, in biotechnology applications.
Mapping between Cos and PSOs	
Course Content	**UNIT – 1: Advanced Techniques for Protein Analysis** Advanced Western blotting: quantitative Western, normalization, common pitfalls. Tag-based and affinity purification: basic idea of fusion/epitope tags (His, GST, FLAG) and Ni-NTA/antibody-based affinity chromatography. Flow cytometry: principle of fluorescence-based single-cell analysis, basic plots/gating idea, and key applications (immunophenotyping of immune cells, apoptosis, cell cycle – at concept level). Protein–protein interaction methods: Basic concept of co-immunoprecipitation (Co-IP). Immunofluorescence techniques: Basic principle of fluorescence-based protein localization (concept level).
	Teaching Hours: 15

	UNIT – 2: Advanced Techniques in Nucleic Acid & PCR Isothermal amplification: basic concepts and application of LAMP. Nucleic acid hybridization: principles and uses of Southern and Northern blotting. Primer design: Basic principles of primer design for nucleic acid amplification. DNA–protein interaction analysis: Basic concept of Electrophoretic Mobility Shift Assay (EMSA). Comparative analysis of molecular techniques: Selection of amplification and hybridization methods for research and diagnostic applications. Applications in molecular diagnostics: Role of molecular techniques in pathogen detection and disease diagnosis.	Teaching Hours: 15
Reference Books	• Green, M.R., & Sambrook, J. (2012). Molecular Cloning: A Laboratory Manual (4th ed.). New York: Cold Spring Harbor Laboratory Press. • Brown, T.A. (2020). Gene Cloning and DNA Analysis: An Introduction (7th ed.). Oxford: Wiley-Blackwell. • Primrose, S.B., & Twyman, R.M. (2013). Principles of Gene Manipulation and Genomics (8th ed.). Oxford: Wiley-Blackwell. • Simpson, R.J. (2003). Proteins and Proteomics: A Laboratory Manual. New York: Cold Spring Harbor Laboratory Press. • Lesk, A.M. (2016). Introduction to Protein Science: Architecture, Function and Genomics (3rd ed.). Oxford: Oxford University Press. • Buckingham, L., & Flaws, M. (2019). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications (3rd ed.). Philadelphia: F.A. Davis Company. • Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., & Losick, R. (2014). Molecular Biology of the Gene (7th ed.). Boston: Pearson Education. • Simpson, R.J. (2003). *Proteins and Proteomics: A Laboratory Manual*. New York: Cold Spring Harbor Laboratory Press. • Doudna, J.A., & Sternberg, S.H. (2017). *A Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution*. Boston: Houghton Mifflin Harcourt. • Buckingham, L., & Flaws, M.L. (2019). *Molecular Diagnostics: Fundamentals, Methods and Clinical Applications* (3rd ed.). Philadelphia: F.A. Davis Company. **E-Resources** • Genome Editing and Engineering (https://onlinecourses.nptel.ac.in/noc24_bt71/preview) • Computational Genomics (https://onlinecourses.nptel.ac.in/noc26_bt39/preview) Research/Review papers • https://pubmed.ncbi.nlm.nih.gov/12634793/ • https://pubmed.ncbi.nlm.nih.gov/10871386/ • https://pubmed.ncbi.nlm.nih.gov/20685252/	

	• https://pubmed.ncbi.nlm.nih.gov/15900442/ • https://pubmed.ncbi.nlm.nih.gov/24738055/ • https://pubmed.ncbi.nlm.nih.gov/19400705/ • https://pubmed.ncbi.nlm.nih.gov/18474036/ • https://pubmed.ncbi.nlm.nih.gov/26551336/ • https://pubmed.ncbi.nlm.nih.gov/28667615/ • https://pmc.ncbi.nlm.nih.gov/articles/PMC6918834/
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

[Subject code-2703083302011002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS	
Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6.0
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BTP-2001
Course Level	500-599
Course Title	Advanced Molecular Techniques: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: Integrate and apply immunological, molecular biology, and bioinformatics approaches to design, perform, and analyze experimental and in silico workflows, including PCR optimization, protein analysis, antigen design, and recombinant DNA techniques, for accurate data interpretation in research and diagnostic application
Mapping between	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

COs and PSOs		
Course Content	1. Immunological Assays and Flow Cytometry Data Analysis (ELISA – indirect/sandwich and virtual flow cytometry interpretation) 2. Primer Design, *In Silico* PCR Validation, and Advanced Design Strategies 3. PCR Optimization and Gradient PCR Analysis 4. Bioinformatics Analysis of Protein Structure, Localization, and Function 5. Rational Antigen Design and Epitope Prediction 6. Recombinant DNA Analysis and Quantitative Data Interpretation (Restriction mapping, plasmid construction, gel densitometry using ImageJ, and EMSA concept)	Teaching Hours: 60
Reference Books	• Green, M.R., & Sambrook, J. (2012). Molecular Cloning: A Laboratory Manual (4th ed.). New York: Cold Spring Harbor Laboratory Press. • Brown, T.A. (2020). Gene Cloning and DNA Analysis: An Introduction (7th ed.). Oxford: Wiley-Blackwell. • Primrose, S.B., & Twyman, R.M. (2013). Principles of Gene Manipulation and Genomics (8th ed.). Oxford: Wiley-Blackwell. • Simpson, R.J. (2003). Proteins and Proteomics: A Laboratory Manual. New York: Cold Spring Harbor Laboratory Press. • Lesk, A.M. (2016). Introduction to Protein Science: Architecture, Function and Genomics (3rd ed.). Oxford: Oxford University Press. • Buckingham, L., & Flaws, M. (2019). Molecular Diagnostics: Fundamentals, Methods and Clinical Applications (3rd ed.). Philadelphia: F.A. Davis Company. • Watson, J.D., Baker, T.A., Bell, S.P., Gann, A., Levine, M., & Losick, R. (2014). Molecular Biology of the Gene (7th ed.). Boston: Pearson Education. • Simpson, R.J. (2003). *Proteins and Proteomics: A Laboratory Manual*. New York: Cold Spring Harbor Laboratory Press. • Doudna, J.A., & Sternberg, S.H. (2017). *A Crack in Creation: Gene Editing and the Unthinkable Power to Control Evolution*. Boston: Houghton Mifflin Harcourt. • Buckingham, L., & Flaws, M.L. (2019). *Molecular Diagnostics: Fundamentals, Methods and Clinical Applications* (3rd ed.). Philadelphia: F.A. Davis Company.	
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments	
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-2002
Course Level	500-599
Course Title	Bioinformatics and Data Science
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	**CO1:** To introduce fundamental concepts of bioinformatics and data science relevant to biological research. **CO2:** To develop basic skills in biological data analysis, visualization, and interpretation.

Mapping between Cos and PSOs

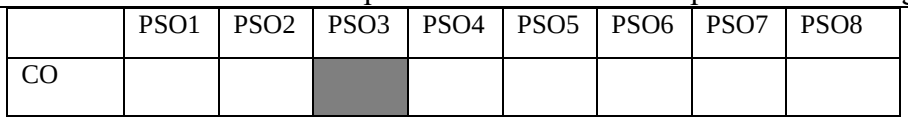
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content

UNIT – 1: Introduction to Bioinformatics Definition, scope, and applications of bioinformatics, biological data types: sequence, structure, expression, variation, Overview of omics technologies: genomics, transcriptomics, proteomics, metabolomics, biological databases: primary, secondary, and composite databases, Introduction to data standards and data formats (FASTA, GenBank, PDB)	Teaching Hours: 15
UNIT – 2: Sequence Analysis and Data Science Basics Pairwise sequence alignment: global and local alignment, Database similarity search tools: BLAST, FASTA, Multiple sequence alignment: Clustal Omega, MUSCLE (concepts), Introduction to data science: data types, data preprocessing, cleaning, Introduction to Next-Generation Sequencing (NGS) data analysis, including quality control (FastQC), sequence alignment (e.g., BWA/Bowtie), variant calling (GATK), and basic downstream analysis and interpretation.	Teaching Hours: 15

Reference Books	• Baxevanis, A. D. & Ouellette, B. F. F. Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins • Mount, D. W. Bioinformatics: Sequence and Genome Analysis • Pevsner, J. Bioinformatics and Functional Genomics • Lesk, A. M. Introduction to Bioinformatics • Higdon et al. Biological Data Analysis • Bioinformatics Data Skills – Vince Buffalo, O'Reilly Media • Next-Generation DNA Sequencing Informatics – Cold Spring Harbor Laboratory Press • FastQC – Babraham Bioinformatics • Genome Analysis Toolkit (GATK) – Broad Institute • Burrows-Wheeler Aligner (BWA) – Li & Durbin
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-2002
Course Level	500-599
Course Title	Bioinformatics and Data Science: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	CO: Demonstrate proficiency in the use of bioinformatics tools and databases to retrieve, analyze, and interpret nucleotide and protein sequences, perform sequence alignment (pairwise and multiple), conduct similarity searches using BLAST, and visualize three-dimensional protein structures for comprehensive biological analysis.
Mapping between Cos and PSOs	
Course Content	1. Introduction to bioinformatics tools and databases & retrieval of nucleotide and protein sequences from NCBI 2. Use of UniProt for protein information analysis 3. Pairwise sequence alignment using online tools 4. BLAST analysis for sequence similarity search 5. Multiple sequence alignment using Clustal Omega 6. Retrieval and visualization of protein structures from PDB Teaching Hours : 60
Reference Books	• *Bioinformatics: Methods and Applications* (co-authored with N. Mendiratta and P. Rastogi) • Baxevanis, A. D. & Ouellette, B. F. F. *Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins* • Mount, D. W. *Bioinformatics: Sequence and Genome Analysis* • Pevsner, J. *Bioinformatics and Functional Genomics* • Lesk, A. M. *Introduction to Bioinformatics* • Higdon et al. *Biological Data Analysis*
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BT-2003
Course Level	500-599
Course Title	Entrepreneurship in Life Sciences
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	**CO1:** Students will be able to explain concepts of innovation, biotechnology entrepreneurship and start-up ecosystem including TRL and bio economy. **CO2:** Students will be able to apply basic business models, intellectual property concepts, regulatory frameworks and financial principles in biotechnology ventures.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content		
	UNIT – 1: Innovation & Biotechnology Entrepreneurship Ecosystem Concept of Innovation & Design Thinking, Types of Innovation in Life Sciences, Overview of Biotechnology Entrepreneurship, Start-up Ecosystem in India & Gujarat (BIRAC, GSBTM, Start-up India), Introduction to Bioeconomy & Sustainable Entrepreneurship, Technology Readiness Levels (TRL) – Basic Concept	Teaching Hours: 15
	UNIT – 2: Fundamentals of Business & Commercialization Basics of Business Models (Business Model Canvas), Introduction to Intellectual Property Rights (Patents – Overview), Introduction to Regulatory Bodies (CDSCO, FSSAI – Overview), Basic Financial Literacy: Costing, Break-even Concept, Marketing Basics for Biotech Products, Ethical & Societal Considerations in Biotech Ventures	Teaching Hours: 15

Reference Books

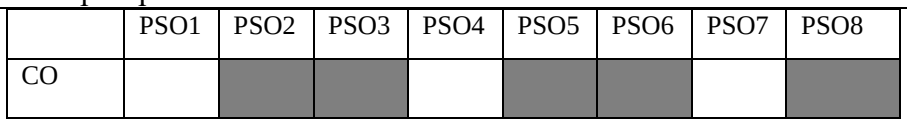
- Shimasaki, C. (2014) Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Academic Press, USA.
- Drucker, P. F. (2014) Innovation and Entrepreneurship. Harper Business.
- Osterwalder, A., & Pigneur, Y. (2010) Business Model Generation. Wiley, USA.

	• Desai, V. Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House, India. • Gopalakrishnan, N. S., & Agitha, T. G. (2017) Principles of Intellectual Property. Eastern Book Company, India.
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.

[Subject code-2703083302033002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BTP-2003
Course Level	500-599
Course Title	Entrepreneurship in Life Sciences: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	CO: Students will be able to develop, analyze and present a feasible biotechnology startup idea by applying business model tools, conducting market feasibility assessment, performing basic financial evaluation and preparing a structured startup concept report.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

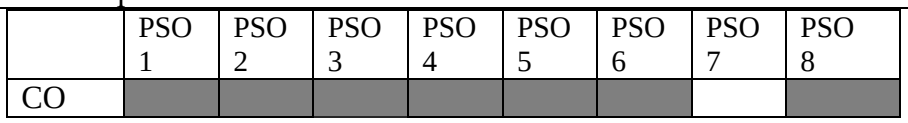
Course Content	1. Business Model Canvas Preparation 2. Market Survey & Feasibility Study 3. Entrepreneur Interview & Report Writing 4. Cost Estimation & Break-even Calculation Exercise 5. TRL Identification Exercise 6. Preparation of Mini Start-up Concept Note 7. Pitch Presentation 8. Submission of Start-up Concept Report (5–8 Pages)	Teaching Hours: 60
Reference Books	• Shimasaki, C. (2014) Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Academic Press, USA. • Drucker, P. F. (2014) Innovation and Entrepreneurship. Harper Business. • Osterwalder, A., & Pigneur, Y. (2010) Business Model Generation. Wiley, USA. • Desai, V. Dynamics of Entrepreneurial Development and Management. Himalaya Publishing House, India. • Gopalakrishnan, N. S., & Agitha, T. G. (2017) Principles of Intellectual Property. Eastern Book Company, India.	
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments	
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.	

[Subject code-2703083302044001]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT SYLLABUS	
Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6.0
Course Type	Vocational
Course Subtype	Skill Development
Subject Type	Vocational Education
Course Code	BT-2004
Course Level	500-599
Course Title	Aquaculture
Credit	2

<table>
<tr><td>Effective From</td><td colspan="2">Academic Year: 2026-27</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">CO1: Explain the fundamentals of aquaculture, sustainable practices, biological characteristics of aquatic organisms, biofouling, and the basic concept of marine bioactive compounds and algal biotechnology.
CO2: Analyze the application of biotechnological tools in aquaculture, including gene and chromosomal manipulation and apply molecular techniques for disease diagnosis and health management.</td></tr>
<tr><td>Mapping between Cos and PSOs</td><td colspan="2"><table><tr><th></th><th>PSO 1</th><th>PSO 2</th><th>PSO 3</th><th>PSO 4</th><th>PSO 5</th><th>PSO 6</th><th>PSO 7</th><th>PSO 8</th></tr><tr><td>CO1</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr><tr><td>CO2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td rowspan="2">Course Content</td><td>UNIT – 1: Fundamentals of Aquaculture
Concept of Blue Revolution- Introduction, scope and significance of aquaculture. Sustainable aquaculture. General characters of fishes, shellfishes, crustaceans. Biofouling. Marine Bioactive Compounds and Algal Biotechnology.</td><td>Teaching Hours: 15</td></tr>
<tr><td>UNIT – 2: Aquaculture Biotechnology and Health Management
Gene manipulation in fish and transgenic fish production. Chromosomal manipulation (ploidy manipulation, gynogenesis, androgenesis). Applications of recombinant hormones and growth factors. Disease diagnosis and health management (Bacterial, viral and fungal Diseases)</td><td>Teaching Hours: 15</td></tr>
<tr><td>Reference Books</td><td colspan="2">• Selvamani, B. R., & Mahadevan, R. K. (2008). Fish health and Diseases. Campus Books International.
• Jadhav, U. (2009). Aquaculture technology and environment. PHI Learning Pvt. Ltd.
• Dunham, R. (2023). Aquaculture and fisheries biotechnology: genetic approaches. Cabi.
• Pillay, T. V. R. (2008). Aquaculture and the Environment. John Wiley & Sons.</td></tr>
<tr><td>Teaching Methodology</td><td colspan="2">Classwork, Discussion, Self-Study, Seminars and/or Assignments</td></tr>
<tr><td>Evaluation Method</td><td colspan="2">50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.</td></tr>
</table>

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
SYLLABUS

Program Name	M. Sc. Biotechnology
Semester	II/VIII
NCrF Credit Level	6.0
Course Type	Vocational
Course Subtype	Skill Development
Subject Type	Vocational Education
Course Code	BTP-2004
Course Level	500-599
Course Title	Aquaculture: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	CO: Students will be able to identify and classify commercially important aquatic organisms, perform microbial and molecular analyses of aquaculture samples, extract value-added products from aquaculture waste, and understand recent advancements and industrial applications in aquaculture through practical and field-based exposure.
Mapping between Cos and PSOs	
Course Content	1. To study commercially important fishes, freshwater algae and seaweeds. 2. Microbial analysis of Fish/prawn. 3. Extraction of chitin from aquaculture Waste. 4. Detection of White Spot Syndrome Virus (WSSV) in shrimps by PCR technique (Demonstration). 5. Review Article on any recent/emerging areas of aquaculture (OR) Industrial / Field Visit to Marine Research / Aquaculture Facility. Teaching Hours: 60
Reference Books	• Meyers, T. R. (Ed.). (2009). *Fish pathology section laboratory manual*. Alaska Department of Fish and Game, Division of Commercial Fisheries. • https://www.cd-genomics.com/diseasepanel/products/shrimp-white-spot-syndrome-virus-wssv-real-time-pcr-kit-435.html
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignments
Evaluation Method	50% CCE: Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination etc. 50% SEE: External assessment based on semester end University examination.