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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ક્રમાંક :એસ./પરિપત્ર/૧૬૦૮૮/૨૦૨૩
તા.૨૭/૦૬/૨૦૨૩

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

વિષયઃ– બી.એસસી.બાયોટેકનોલોજી વિષયનાં સેમેસ્ટર–૧ અને ૨ ના અભ્યાસક્રમ બાબત.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ–૨૦૨૩–૨૪ થી અમલમાં આવનાર NEP-2020 અંતર્ગત B.Sc.Biotechnology પ્રોગ્રામના સેમેસ્ટર– ૧ અને ૨ નો Major અને Minor નો પેટાસમિતિ દ્વારા તૈયાર કરેલ અભ્યાસક્રમ સંદર્ભે બાયોટેકનોલોજી વિષયની (નિયુકત) એડહોક સમિતિની તા.૧૦/૦૬/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૧૯/૦૬/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૧૪ અન્વયે કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૨૩/૦૬/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ૩૪ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની(નિયુકત) એડહોકસમિતિની તા.૧૦/૦૬/૨૦૨૩ની સભાનાં ઠરાવક્રમાંકઃ ૨</u>

:: આથી ઠરાવવામાં આવે છે કે,શૈક્ષણિક વર્ષ–૨૦૨૩–૨૪ થી અમલમાં આવનાર NEP-2020 અંતર્ગત બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– ૧ અને ૨ નો Major અને Minor નો પેટાસમિતિ દ્વારા તૈયાર કરેલ અભ્યાસક્રમસુધારા વધારા સાથે સર્વાનુમતે મંજૂર કરી તે મંજૂર કરવા વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

વિજ્ઞાન વિદ્યાશાખાની તા.૧૯/૦૬/૨૦૨૩ ની સભાની ઠરાવ ક્રમાંકઃ૧૪

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની (નિયુકત) એડહોક સમિતિની તા.૧૦/૬/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે કરેલ ભલામણ સ્વીકારી શૈક્ષણિક વર્ષ–૨૦૨૩–૨૪ થી અમલમાં આવનાર NEP-2020 અંતર્ગત બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– ૧ અને ૨ નો Major અને Minor નો પેટાસમિતિ દ્વારા તૈયાર કરેલ અભ્યાસક્રમ સુધારા વધારા સાથે સર્વાનુમતે મંજૂર કરી તે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૨૩/૦૬/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ૩૪

:: આથી ઠરાવવામાં આવે છે કે, વિજ્ઞાન વિદ્યાશાખાની તા.૧૯/૦૬/૨૦૨૩ ની સભાની ઠરાવ ક્રમાંકઃ૧૪ અન્વયે કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

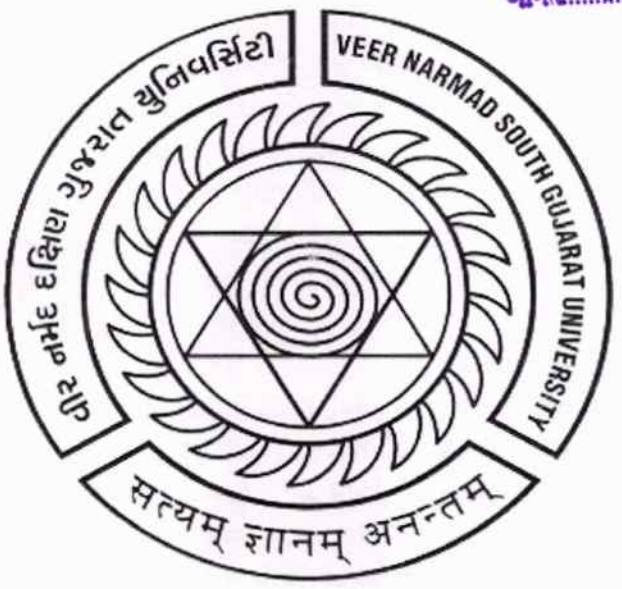
(બિડાણઃ ઉપર મુજબ)

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



Undergraduate Program

In

Biotechnology

[3 years (Degree) & 4 years (Honours/Honours with Research)]

Program Outcome (PO):

1. Strong foundation in biological sciences: Students will have a comprehensive understanding of fundamental concepts in biology, genetics, microbiology, biochemistry, and molecular biology. This knowledge will provide a solid base for further specialization in biotechnology.
2. Practical laboratory skills: Learners will gain hands-on experience in various laboratory techniques and instrumentation commonly used in biotechnology research and industry. This includes DNA/RNA isolation & purification, DNA sequencing, protein purification, cell culture, genetic engineering, and bioinformatics.
3. Critical thinking and problem-solving abilities: Through coursework, projects, and research opportunities, students will develop analytical skills to identify and address scientific problems in the field of biotechnology. This involves experimental design, data analysis, and interpretation.
4. Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science, and pharmaceuticals.
5. Research experience: Many programs offer research opportunities, allowing students to work on cutting-edge projects alongside faculty members or industry professionals. This hands-on research experience will enhance their understanding of scientific methodologies and foster innovation in biotechnology.
6. Communication and teamwork skills: Collaboration is an essential aspect of biotechnology. Through group projects, presentations, and scientific writing assignments, students will develop effective communication skills and the ability to work collaboratively with peers, scientists, and industry professionals.
7. Ethical considerations: Biotechnology has ethical implications, and learners will gain an understanding of the ethical, legal, and societal aspects associated with the field. This knowledge will help them make informed decisions and contribute responsibly to the biotechnology industry.
8. Entrepreneur Skill: In addition to scientific knowledge, the program may foster entrepreneurial skills and an entrepreneurial mind-set. This includes teaching learners how to identify market opportunities, develop business plans, understand intellectual property rights, and navigate the commercialization process for biotechnological innovations. These skills can empower students to turn scientific discoveries into viable products or services, start their own biotechnology venture, or contribute to the growth of existing biotech companies.

Overall, a 4-year undergraduate program in Biotechnology with honours & honours with research will equip student with a strong theoretical foundation, practical skills, and the ability to contribute to the advancement of biotechnology through research and innovation. It can prepare them for further academic pursuits, such as to provide a solid foundation for various career paths in biotechnology research, industry, or related fields.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology-Major

Teaching & Evaluation Scheme

Semester-I & II

[Academic Year of Implementation 2023-2024]

Semester-I

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Schedule			Total Theory/Practical Marks	Credit
			Duration (Hours)	Internal Marks	External Marks		
BT-MJ-101	Introduction to Biotechnology	3	2	20	50	70	3
BT-MJ-102	Cell Biology	3	2	20	50	70	3
BTP-MJ-1	Practical	4	4	20	40	60	2
			Total	**60**	**140**	**200**	**8**

Semester-II

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Schedule			Total Theory/Practical Marks	Credit
			Duration (Hours)	Internal Marks	External Marks		
BT-MJ-201	Biochemistry of Water	3	2	20	50	70	3
BT-MJ-202	Biomolecules	3	2	20	50	70	3
BTP-MJ-2	Practical	4	4	20	40	60	2
			Total	**60**	**140**	**200**	**8**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BT-MJ-101: Introduction to Biotechnology

Course Code	BT-MJ-102
Course Title	**Introduction to Biotechnology**
Credit	3
Total engagement	3 Credits x 15 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	With the use of cutting-edge biotechnology, mankind are currently able to combat crippling and rare diseases, reduce our impact on the environment, alleviate hunger, use less and cleaner energy, and develop safer, cleaner, and more efficient industrial manufacturing processes.
Course Objective	The goal of the biotechnology curriculum is to provide students with a fundamental understanding of scientific theories of biotechnology, hands-on experiments, techniques, and methods. It also aims to apprise students with recent advancement in the field of Biotechnology.
Course Outcomes	CO1: To understand the basic concepts, history and knowledge about of Biotechnology by learning its global impact on society as well as environment. CO2: Students will learn about the recent advancement and trends in biotechnology sector both public and privet sector, different initiatives to encourage and motivate students to explore diverse avenues such as research funding, start-up endeavour's, skill-oriented training, and employment opportunities. CO3: Acquire knowledge in students of biotechnology enabling them applications in industry and research.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Pre-requisite	Biology	
Course Content	**UNIT-1: Basic Concept of Biotechnology:** Introduction, Definition of Biotechnology, History of Biotechnology, Old and New Biotechnology, Biotechnology as interdisciplinary area, Different colors of Biotechnology, Biotechnology: Three component central core, Global impact and current excitement of Biotechnology.	Teaching Hours: 12
	UNIT-2: Biotechnology in State and Nation: Role of GSBTM, STBI and GBRC; Innovation and Entrepreneurship Ecosystem, Incubation centres and Regulatory bodies; Introduction to DBT, Autonomous	Teaching Hours: 15

	institutions of DBT, Public Sector undertaking of DBT, BTIS-NET, Introduction to ABLE.	
	UNIT-3: Applications of Biotechnology Agricultural Biotechnology, Medical Biotechnology, Environmental Biotechnology, Food Biotechnology, Industrial Biotechnology, Genetic Engineering, Economics and Biotechnology: Advent of Econo-Biotechnology.	Teaching Hours: 18
Reference Books	• Sobti, R. C., & Pachouri, S. S. (2008). *Essentials of Biotechnology* (1st ed) Ane Books Pvt. Ltd. • Smith, *J.* E. (2009). *Biotechnology* (5th ed). Cambridge University Press; https://doi.org/10.1017/CBO9780511802751 • Ratledge, *C.* (2006). *Basic biotechnology (2006)* (1st ed), Publisher: Cambridge University Press, ISBN: 9780511802409. https://doi.org/10.1017/CBO978051180240 • Gupta, P. K. (2010). *Elements of biotechnology* (2nd ed). • Singh, B. D. (2010). *Biotechnology* (4th ed), Kalyani Publishers. Dubey, R. C. (2022). *A textbook of Biotechnology. S. Chand* (5th ed).	
e-learning resources	https://dbtindia.gov.in/ https://btm.gujarat.gov.in/ https://gbrc.gujarat.gov.in/ https://stbi.gujarat.gov.in/ https://dbtindia.gov.in/scientific-decision-units/computational-biology/btis-network http://www.btisnet.gov.in/ https://ableindia.in/	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BT-MJ-102: Cell Biology

Course Code	BT-MJ-102
Course Title	**Cell Biology**
Credit	3
Total engagement	3 Credits x 15 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	The goal of this course is to introduce students with a very basic knowledge and understanding of the basic unit of life: the cell, its structure, composition and function.
Course Objective	The course will stand on its utility towards learning and implementing the aspects towards basic cell biology.
Course Outcomes	The student at the completion of the course will be able to CO1: Understand the structure and function of eukaryotic and prokaryotic cells. CO2: To be familiar with all the cell organelles. CO3: Students will acquire detailed knowledge of how a cell divides leading to the growth of an organism.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Pre-requisite	Biology	
Course Content	**UNIT-1: Cell as a Basic unit of Living Systems:** Discovery of cell, The cell theory, Ultra structure of a eukaryotic (plant and animal cells) and prokaryotic cell, Structural organization and functions of plasma membrane and cell wall of eukaryotes.	Teaching Hours:12
	UNIT-2: Cellular Organelles: Structure and functions of cell organelles– Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).	Teaching Hours:17

	UNIT-3: Cell Division: Cell cycle- Cell cycle *in vivo*, Control of cell cycle. M Phase: Mitosis and Cytokinesis- Prophase, Pro-metaphase, Metaphase, Anaphase, Telophase. Forces required for mitotic movements, Cytokinesis, Meiosis- The stages of meiosis, Genetic recombination during meiosis. Various cell division mechanism in prokaryotes.	Teaching Hours:16
Reference Books	• Gerald Karp (2014). Cell Biology VII Edition. WILEY. • Lodish *et al* (2008). Molecular Cell Biology. VI Edition. Freeman & Co, USA. • De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia. • Cooper, G.M. and Hausman, R.E. (2007). The Cell: A Molecular Approach. IV Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BTP-MJ-1: Practical

Course Code	BTP-MJ-1
Course Title	**Practical**
Credit	2
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h X 1 day = 4 h
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	The purpose of this course is to provide participants with a comprehensive understanding of laboratory safety practices, essential laboratory equipment, sterilization techniques, proper handling of laboratory waste, and various staining and counting procedures commonly used in scientific research and analysis.
Course Objective	The objective of this course is to equip participants with the necessary knowledge and skills related to laboratory safety, equipment operation, sterilization techniques, waste management, and staining/counting procedures.
Course Outcomes	By the end of this course, students will have: • Developed a strong understanding of laboratory safety rules and regulations, ensuring their ability to create and maintain a safe working environment. • Acquired knowledge of the principles, working mechanisms, and applications of key laboratory instruments, enabling them to use these instruments effectively in scientific research and analysis. • Gained expertise in the principles, working mechanisms, and uses of sterilizers, allowing them to properly sterilize laboratory equipment and materials. • Mastered the techniques for preparing and sterilizing glassware and culture media, minimizing contamination risks in laboratory experiments. • Gained awareness of proper waste disposal and segregation practices, contributing to environmentally friendly and safe laboratory operations. • Acquired practical skills in DNA staining using Schiff's reagent and *Allium cepa* peel, facilitating genetic analysis. • Developed the ability to study and identify divisional stages in mitosis using onion root tips, enhancing understanding of cellular processes. • Attained knowledge and proficiency in identifying Barr bodies from Buccal smears, aiding in genetic investigations. • Gained practical experience in Geimsa staining for blood cell analysis, enabling them to identify and study various blood cell types.

<table>
<tr><td></td><td>• Acquired the skill to perform R. B. C. counts using a Haemocytometer, facilitating quantitative analysis in hematology.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td><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 1-10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td>Basics of Biology, Biotechnology, Biochemistry, Microbiology</td></tr>
<tr><td>Course Content</td><td>1. Understanding laboratory safety and rules.
2. Principle, working and use of: Microscope, Incubator, pH meter & Centrifuge.
3. Principle, working and uses of sterilizer: Hot air oven and Autoclave.
4. Preparation and sterilization of glassware's and Culture media.
5. Laboratory waste and biomedical waste disposal and segregation.
6. DNA staining by Schiff's reagent using peel of Allium cepa.
7. Study of divisional stages in mitosis from onion root tips.
8. Barr body from Buccal smear.
9. Geimsa staining of blood cells.
10. R. B. C count by Haemocytometer.</td></tr>
<tr><td>Reference Books</td><td>• Patel, R. (2019) Experimental Microbiology vol 1 and vol 2, 5th ed. Aditya Publication.
• Nigam, A. and Ayyagari, A. (2007) Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw-Hill Publishing Company, New Delhi.
• Aneja, K. R. (2014) Laboratory Manual of Microbiology and Biotechnology, MedTech, Scientific International Pvt. Ltd., New Delhi.</td></tr>
<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, internal examination, etc. 70% External based onsemester end University examination</td></tr>
</table>

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BT-MJ-201: Biochemistry of Water

Course Code	BT-MJ-201
Course Title	**Biochemistry of Water**
Credit	3
Total engagement	3 Credits x 15 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	It provides a comprehensive understanding of the fundamental role of water plays in biological systems. It is designed to provide solid foundation for understanding the intricate interplay between water and biological systems.
Course Objective	By exploring the biochemistry of water, students will gain insights into its unique physical and chemical properties, including hydrogen bonding, polarity and its influence on bio-molecular interactions. Understanding these principles is vital for comprehending various biological processes, such as enzyme catalysis, protein folding, and the stability of biomolecules.
Course Outcomes	CO1: Upon completing this unit, student will have a strong understanding of the evolution of life on Earth, the chemical foundations of biochemistry, and the weak interactions in aqueous systems. They will be equipped with the knowledge and analytical skills necessary to study biological systems at the molecular level, interpret biological phenomena, and pursue further studies or careers in life sciences. CO2: By the end of this unit, students should have a solid understanding of the ionization of water, weak acids, and weak bases, as well as the principles and mechanisms behind buffering against pH changes in biological systems. CO3: The topics on water as a reactant and the fitness of the aqueous environment for living organisms aims to provide students with a comprehensive understanding of the role of water in chemical reactions and its significance for sustaining life.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Pre-requisite	Chemistry, Biology	
Course Content	**UNIT-1:** Introduction; Landmarks in the evolution of life on Earth; Chemical foundations of Biochemistry; Weak interactions in Aqueous systems.	Teaching Hours: 20

	UNIT-2: Ionization of water, weak acids and weak bases; Buffering against pH changes in biological systems.	Teaching Hours: 15
	UNIT-3: Water as a reactant; The fitness of the Aqueous Environment for Living Organisms.	Teaching Hours: 10
Reference Books	• Nelson, D. L. and Cox, M. M. (2017) Lehninger: Principles of Biochemistry 7th Edition, W. H. Freeman, Macmillan Learning, New York.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BT-MJ-202: Biomolecules

Course Code	BT-MJ-202
Course Title	**Biomolecules**
Credit	3
Total engagement	3 Credits x 15 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	To give students basic idea regarding biomolecules
Course Objective	Students will know the basics about Biomolecules
Course Outcomes	CO1: Students will know about hetero-polysaccharides and nucleic acid CO2: Students will aware about basic structure, types and variety of amino acids proteins functions CO3: Students will get the knowledge of different types of lipids with its properties.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Pre-requisite	Biology	
Course Content	**UNIT-1: Carbohydrates and Nucleic Acid:** Carbohydrate: Definition and Classification, Polysaccharides and its types, Biologically important glycosides, Carbohydrates as information molecules, Nucleosides and nucleotides, Structure of DNA and RNA (m-RNA, t-RNA, r-RNA, hn-RNA).	Teaching Hours: 15
	UNIT-2: Amino acids and Proteins: Amino acids and its classification, Non-Standard amino acids, Non-protein amino acids, Classifications of proteins (based on –source, shape, composition and solubility) Properties of proteins, Structure of proteins, Biological roles of proteins.	Teaching Hours: 15
	UNIT-3: Lipids: Lipids: Definition and Classification, Physical properties of Lipids, Biological roles of Lipids.	Teaching Hours: 15

Reference Books	• Cox, D. N. (2017). Lehninger Principles of Biochemistry (7th ed.). New York: Macmillan education. • Jain & Jain (2009). Fundamentals of Biochemistry. New Delhi: S. Chand. • U. Satyanarayana, U. a. (2019). Biochemistry (5th ed.). new delhi: RELX india and Books and Allied Pvt. Ltd.
e-learning resources	SWAYAM (https://swayam.gov.in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BTP-MJ-2: Practical

Course Code	BTP-MJ-2
Course Title	**Practical**
Credit	2
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h X 1 day = 4 h
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	Course aims to provide students with a strong foundation in laboratory techniques and scientific methodology, enabling them to approach scientific investigations with confidence, precision, and a thorough understanding of the principles and techniques involved.
Course Objective	The objective of the course is to provide students with a comprehensive understanding of scientific methodology and laboratory techniques. It aims to develop their skills in experimental design, data collection, analysis, and interpretation. The course focuses on exploring various scientific phenomena, such as surface tension, buffer systems, and qualitative tests for carbohydrates, proteins, and lipids.
Course Outcomes	By the end of this course: • Students will understand the importance of formulating a hypothesis, collecting and analyzing data, and drawing conclusions based on the results obtained. • Participants will be proficient in measuring the surface tension of water and comparing it to solutions with varying concentrations. They will understand how solutes affect surface tension and be able to interpret the results obtained through experimental analysis. • Students will be able to plot a titration curve and determine the pKa value of a weak acid. They will understand the principles behind acid-base titrations and be able to analyze experimental data to obtain accurate pKa values. • Students will understand the concepts of buffering and be able to calculate the buffer capacity based on experimental measurements. • Participants will have a comprehensive understanding of buffer systems commonly found in biological systems. They will be able to identify and analyze the components of buffer systems, as well as their importance in maintaining pH stability in biological processes. • They will be familiar with various chemical reagents used in carbohydrate analysis and understand the principles behind these tests, enabling them to identify the presence of carbohydrates in different samples.

<table>
<tr><td></td><td>

They will possess the knowledge of specific reagents and techniques used in protein detection, allowing them to identify the presence of proteins in various samples.
They will understand the chemical reactions involved in lipid detection and be able to interpret the results obtained through these tests, enabling them to identify the presence of lipids in different samples.
Participants will be capable of determining various parameters such as acid value, iodine number, and saponification number. They will understand the principles behind these measurements and their significance in analyzing the quality and properties of oils and fats.
Participants will gain proficiency in protein estimation using methods such as Folin-Lowry, Bradford, and Bromo Cresol Green (BCG). They will be able to perform accurate protein estimations, and interpret the results obtained through these techniques.

</td></tr>
<tr><td>Mapping between COs with PSOs</td><td>
<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 1-10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td>Basics of Biology, Biotechnology, Biochemistry, Microbiology</td></tr>
<tr><td>Course Content</td><td>

Scientific method introduction: Design and conduct a simple experiment to investigate a scientific question, including formulating a hypothesis, data collection and analysis.
Measure the surface tension of water and compare it with solutions of different concentrations, investigating the impact of solutes on surface tension.
Plot a titration curve and determine the pKa value of the weak acid.
Determining capacity of buffer solution.
Explore buffer systems commonly found in biological systems.
Qualitative test for carbohydrates.
Qualitative test for proteins.
Qualitative test for lipids.
Acid Value/Iodine Number/Saponification Number.
Folin-Lowry/Bradford/Bromo Cresol Green (BCG) method for protein estimation.

</td></tr>
<tr><td>Reference Books</td><td>

Patel, R. (2019) Experimental Microbiology vol 1 and vol 2, 5th ed. Aditya Publication.
Kamboj, P. C. (2008) University Practical Chemistry, Vishal Publishing Company, Punjab.
Aneja, K. R. (2014) Laboratory Manual of Microbiology and Biotechnology, MedTech, Scientific International Pvt. Ltd., New Delhi.

</td></tr>
<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, internal examination, etc. 70% External based on semester end University examination</td></tr>
</table>

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program

In

Biotechnology

[3 years (Degree) & 4 years (Honours/Honours with Research)]

Program Outcome (PO):

1. Strong foundation in biological sciences: Students will have a comprehensive understanding of fundamental concepts in biology, genetics, microbiology, biochemistry, and molecular biology. This knowledge will provide a solid base for further specialization in biotechnology.
2. Practical laboratory skills: Learners will gain hands-on experience in various laboratory techniques and instrumentation commonly used in biotechnology research and industry. This includes DNA/RNA isolation & purification, DNA sequencing, protein purification, cell culture, genetic engineering, and bioinformatics.
3. Critical thinking and problem-solving abilities: Through coursework, projects, and research opportunities, students will develop analytical skills to identify and address scientific problems in the field of biotechnology. This involves experimental design, data analysis, and interpretation.
4. Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science, and pharmaceuticals.
5. Research experience: Many programs offer research opportunities, allowing students to work on cutting-edge projects alongside faculty members or industry professionals. This hands-on research experience will enhance their understanding of scientific methodologies and foster innovation in biotechnology.
6. Communication and teamwork skills: Collaboration is an essential aspect of biotechnology. Through group projects, presentations, and scientific writing assignments, students will develop effective communication skills and the ability to work collaboratively with peers, scientists, and industry professionals.
7. Ethical considerations: Biotechnology has ethical implications, and learners will gain an understanding of the ethical, legal, and societal aspects associated with the field. This knowledge will help them make informed decisions and contribute responsibly to the biotechnology industry.
8. Entrepreneur Skill: In addition to scientific knowledge, the program may foster entrepreneurial skills and an entrepreneurial mind-set. This includes teaching learners how to identify market opportunities, develop business plans, understand intellectual property rights, and navigate the commercialization process for biotechnological innovations. These skills can empower students to turn scientific discoveries into viable products or services, start their own biotechnology venture, or contribute to the growth of existing biotech companies.

Overall, a 4-year undergraduate program in Biotechnology with honours & honours with research will equip student with a strong theoretical foundation, practical skills, and the ability to contribute to the advancement of biotechnology through research and innovation. It can prepare them for further academic pursuits, such as to provide a solid foundation for various career paths in biotechnology research, industry, or related fields.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology-Minor

Teaching & Evaluation Scheme

Semester-I & II

[Academic Year of Implementation 2023-2024]

Semester-I

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Schedule			Total Theory/Practical Marks	Credit
			Duration (Hours)	Internal Marks	External Marks		
BT-MN-101	Introduction to Biotechnology	3	2	20	50	70	3
BT-MN-102	Cell Biology	3	2	20	50	70	3
BTP-MN-1	Practical	4	4	20	40	60	2
			Total	**60**	**140**	**200**	**8**

Semester-II

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Schedule			Total Theory/Practical Marks	Credit
			Duration (Hours)	Internal Marks	External Marks		
BT-MN-201	Biochemistry of Water	3	2	20	50	70	3
BT-MN-202	Biomolecules	3	2	20	50	70	3
BTP-MN-2	Practical	4	4	20	40	60	2
			Total	**60**	**140**	**200**	**8**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BT-MN-101: Introduction to Biotechnology

Course Code	BT-MN-102
Course Title	**Introduction to Biotechnology**
Credit	3
Total engagement	3 Credits x 15 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	With the use of cutting-edge biotechnology, mankind are currently able to combat crippling and rare diseases, reduce our impact on the environment, alleviate hunger, use less and cleaner energy, and develop safer, cleaner, and more efficient industrial manufacturing processes.
Course Objective	The goal of the biotechnology curriculum is to provide students with a fundamental understanding of scientific theories of biotechnology, hands-on experiments, techniques, and methods. It also aims to apprise students with recent advancement in the field of Biotechnology.
Course Outcomes	CO1: To understand the basic concepts, history and knowledge about of Biotechnology by learning its global impact on society as well as environment. CO2: Students will learn about the recent advancement and trends in biotechnology sector both public and privet sector, different initiatives to encourage and motivate students to explore diverse avenues such as research funding, start-up endeavour's, skill-oriented training, and employment opportunities. CO3: Acquire knowledge in students of biotechnology enabling them applications in industry and research.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Pre-requisite	Biology	
Course Content	**UNIT-1: Basic Concept of Biotechnology:** Introduction, Definition of Biotechnology, History of Biotechnology, Old and New Biotechnology, Biotechnology as interdisciplinary area, Different colors of Biotechnology, Biotechnology: Three component central core, Global impact and current excitement of Biotechnology.	Teaching Hours: 12
	UNIT-2: Biotechnology in State and Nation: Role of GSBTM, STBI and GBRC; Innovation and Entrepreneurship Ecosystem, Incubation centres and	Teaching Hours: 15

	Regulatory bodies; Introduction to DBT, Autonomous institutions of DBT, Public Sector undertaking of DBT, BTIS-NET, Introduction to ABLE.	
	UNIT-3: Applications of Biotechnology Agricultural Biotechnology, Medical Biotechnology, Environmental Biotechnology, Food Biotechnology, Industrial Biotechnology, Genetic Engineering, Economics and Biotechnology: Advent of Econo-Biotechnology.	Teaching Hours: 18
Reference Books	• Sobti, R. C., & Pachouri, S. S. (2008). *Essentials of Biotechnology* (1st ed) Ane Books Pvt. Ltd. • Smith, *J.* E. (2009). *Biotechnology* (5th ed). Cambridge University Press; https://doi.org/10.1017/CBO9780511802751 • Ratledge, *C.* (2006). *Basic biotechnology (2006)* (1st ed), Publisher: Cambridge University Press, ISBN: 9780511802409. https://doi.org/10.1017/CBO978051180240 • Gupta, P. K. (2010). *Elements of biotechnology* (2nd ed). • Singh, B. D. (2010). *Biotechnology* (4th ed), Kalyani Publishers. Dubey, R. C. (2022). *A textbook of Biotechnology, S. Chand* (5th ed).	
e-learning resources	https://dbtindia.gov.in/ https://btm.gujarat.gov.in/ https://gbrc.gujarat.gov.in/ https://stbi.gujarat.gov.in/ https://dbtindia.gov.in/scientific-decision-units/computational-biology/btis-network http://www.btisnet.gov.in/ https://ablcindia.in/	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BT-MN-102: Cell Biology

<table>
<tr><td>Course Code</td><td colspan="3">BT-MN-102</td></tr>
<tr><td>Course Title</td><td colspan="3">Cell Biology</td></tr>
<tr><td>Credit</td><td colspan="3">3</td></tr>
<tr><td>Total engagement</td><td colspan="3">3 Credits x 15 Hours = 45 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="3">3 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="3">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="3">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="3">The goal of this course is to introduce students with a very basic knowledge and understanding of the basic unit of life: the cell, its structure, composition and function.</td></tr>
<tr><td>Course Objective</td><td colspan="3">The course will stand on its utility towards learning and implementing the aspects towards basic cell biology.</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">The student at the completion of the course will be able to
CO1: Understand the structure and function of eukaryotic and prokaryotic cells.
CO2: To be familiar with all the cell organelles.
CO3: Students will acquire detailed knowledge of how a cell divides leading to the growth of an organism.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="3"><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>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><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td colspan="3">Biology</td></tr>
<tr><td>Course Content</td><td>UNIT-1: Cell as a Basic unit of Living Systems:
Discovery of cell, The cell theory, Ultra structure of a eukaryotic (plant and animal cells) and prokaryotic cell, Structural organization and functions of plasma membrane and cell wall of eukaryotes.</td><td>Teaching Hours:12</td></tr>
<tr><td></td><td>UNIT-2: Cellular Organelles:
Structure and functions of cell organelles– Endoplasmic reticulum, Golgi complex, Mitochondria, Chloroplast, Ribosomes, Lysosomes, Peroxisomes, Nucleus (Nuclear envelope with nuclear pore complex, Nucleolus, Nucleoplasm and Chromatin). Vacuole, Cytosol and Cytoskeleton structures (Microtubules, Microfilaments and Intermediate filaments).</td><td>Teaching Hours:17</td></tr>
</table>

	UNIT-3: Cell Division: Cell cycle- Cell cycle *in vivo*, Control of cell cycle. M Phase: Mitosis and Cytokinesis- Prophase, Pro-metaphase, Metaphase, Anaphase, Telophase. Forces required for mitotic movements, Cytokinesis, Meiosis- The stages of meiosis, Genetic recombination during meiosis. Various cell division mechanism in prokaryotes.	Teaching Hours:16
Reference Books	• Gerald Karp (2014). Cell Biology VII Edition. WILEY. • Lodish et al (2008). Molecular Cell Biology. VI Edition. Freeman & Co, USA. • De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams and Wilkins, Philadelphia. • Cooper, G.M. and Hausman, R.E. (2007). The Cell: A Molecular Approach. IV Edition. ASM Press and Sunderland, Washington, D.C.; Sinauer Associates, MA.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Undergraduate Program in Biotechnology (B. Sc.)
(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-I: Course: BTP-MN-1: Practical

Course Code	BTP-MN-1
Course Title	**Practical**
Credit	2
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h X 1 day = 4 h
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	The purpose of this course is to provide participants with a comprehensive understanding of laboratory safety practices, essential laboratory equipment, sterilization techniques, proper handling of laboratory waste, and various staining and counting procedures commonly used in scientific research and analysis.
Course Objective	The objective of this course is to equip participants with the necessary knowledge and skills related to laboratory safety, equipment operation, sterilization techniques, waste management, and staining/counting procedures.
Course Outcomes	By the end of this course, students will have: • Developed a strong understanding of laboratory safety rules and regulations, ensuring their ability to create and maintain a safe working environment. • Acquired knowledge of the principles, working mechanisms, and applications of key laboratory instruments, enabling them to use these instruments effectively in scientific research and analysis. • Gained expertise in the principles, working mechanisms, and uses of sterilizers, allowing them to properly sterilize laboratory equipment and materials. • Mastered the techniques for preparing and sterilizing glassware and culture media, minimizing contamination risks in laboratory experiments. • Gained awareness of proper waste disposal and segregation practices, contributing to environmentally friendly and safe laboratory operations. • Acquired practical skills in DNA staining using Schiff's reagent and *Allium cepa* peel, facilitating genetic analysis. • Developed the ability to study and identify divisional stages in mitosis using onion root tips, enhancing understanding of cellular processes. • Attained knowledge and proficiency in identifying Barr bodies from Buccal smears, aiding in genetic investigations. • Gained practical experience in Geimsa staining for blood cell analysis, enabling them to identify and study various blood cell types.

	• Acquired the skill to perform R. B. C. counts using a Haemocytometer, facilitating quantitative analysis in hematology.
Mapping between COs with 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 1-10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>
Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology
Course Content	1. Understanding laboratory safety and rules. 2. Principle, working and use of: Microscope, Incubator, pH meter & Centrifuge. 3. Principle, working and uses of sterilizer: Hot air oven and Autoclave. 4. Preparation and sterilization of glassware's and Culture media. 5. Laboratory waste and biomedical waste disposal and segregation. 6. DNA staining by Schiff's reagent using peel of *Allium cepa*. 7. Study of divisional stages in mitosis from onion root tips. 8. Barr body from Buccal smear. 9. Geimsa staining of blood cells. 10. R. B. C count by Haemocytometer.
Reference Books	• Patel, R. (2019) *Experimental Microbiology vol 1 and vol 2, 5th* ed. Aditya Publication. • Nigam, A. and Ayyagari, A. (2007) Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw-Hill Publishing Company, New Delhi. • Aneja, K. R. (2014) Laboratory Manual of Microbiology and Biotechnology, MedTech, Scientific International Pvt. Ltd., New Delhi.
Teaching Methodology	Laboratory work, Journal preparation
Evaluation Method	30% Internal assessment based on class attendance, participation, internal examination, etc. 70% External based onsemester end University examination

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BT-MN-201: Biochemistry of Water

<table>
<tr><td>Course Code</td><td colspan="9">BT-MN-201</td></tr>
<tr><td>Course Title</td><td colspan="9">Biochemistry of Water</td></tr>
<tr><td>Credit</td><td colspan="9">3</td></tr>
<tr><td>Total engagement</td><td colspan="9">3 Credits x 15 Hours = 45 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="9">3 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="9">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="9">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="9">It provides a comprehensive understanding of the fundamental role of water plays in biological systems. It is designed to provide solid foundation for understanding the intricate interplay between water and biological systems.</td></tr>
<tr><td>Course Objective</td><td colspan="9">By exploring the biochemistry of water, students will gain insights into its unique physical and chemical properties, including hydrogen bonding, polarity and its influence on bio-molecular interactions. Understanding these principles is vital for comprehending various biological processes, such as enzyme catalysis, protein folding, and the stability of biomolecules.</td></tr>
<tr><td>Course Outcomes</td><td colspan="9">CO1: Upon completing this unit, student will have a strong understanding of the evolution of life on Earth, the chemical foundations of biochemistry, and the weak interactions in aqueous systems. They will be equipped with the knowledge and analytical skills necessary to study biological systems at the molecular level, interpret biological phenomena, and pursue further studies or careers in life sciences.
CO2: By the end of this unit, students should have a solid understanding of the ionization of water, weak acids, and weak bases, as well as the principles and mechanisms behind buffering against pH changes in biological systems.
CO3: The topics on water as a reactant and the fitness of the aqueous environment for living organisms aims to provide students with a comprehensive understanding of the role of water in chemical reactions and its significance for sustaining life.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="9"><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>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><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td colspan="9">Chemistry, Biology</td></tr>
<tr><td>Course Content</td><td colspan="8">UNIT-1: Introduction; Landmarks in the evolution of life on Earth; Chemical foundations of Biochemistry; Weak interactions in Aqueous systems.</td><td>Teaching Hours: 20</td></tr>
</table>

	UNIT-2: Ionization of water, weak acids and weak bases; Buffering against pH changes in biological systems.	Teaching Hours: 15
	UNIT-3: Water as a reactant; The fitness of the Aqueous Environment for Living Organisms.	Teaching Hours: 10
Reference Books	• Nelson, D. L. and Cox, M. M. (2017) Lehninger: Principles of Biochemistry 7th Edition, W. H. Freeman, Macmillan Learning, New York.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BT-MN-202: Biomolecules

<table>
<tr><td>Course Code</td><td colspan="3">BT-MN-202</td></tr>
<tr><td>Course Title</td><td colspan="3">Biomolecules</td></tr>
<tr><td>Credit</td><td colspan="3">3</td></tr>
<tr><td>Total engagement</td><td colspan="3">3 Credits x 15 Hours = 45 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="3">3 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="3">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="3">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="3">To give students basic idea regarding biomolecules</td></tr>
<tr><td>Course Objective</td><td colspan="3">Students will know the basics about Biomolecules</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">CO1: Students will know about hetero-polysaccharides and nucleic acid
CO2: Students will aware about basic structure, types and variety of amino acids proteins functions
CO3: Students will get the knowledge of different types of lipids with its properties.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="3"><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>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><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td colspan="3">Biology</td></tr>
<tr><td>Course Content</td><td>UNIT-1: Carbohydrates and Nucleic Acid:
Carbohydrate: Definition and Classification, Polysaccharides and its types, Biologically important glycosides, Carbohydrates as information molecules, Nucleosides and nucleotides, Structure of DNA and RNA (m-RNA, t-RNA, r-RNA, hn-RNA).</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td>UNIT-2: Amino acids and Proteins:
Amino acids and its classification, Non-Standard amino acids, Non-protein amino acids, Classifications of proteins (based on –source, shape, composition and solubility) Properties of proteins, Structure of proteins, Biological roles of proteins.</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td>UNIT-3: Lipids:
Lipids: Definition and Classification, Physical properties of Lipids, Biological roles of Lipids.</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>

Reference Books	• Cox, D. N. (2017). Lehninger Principles of Biochemistry (7th ed.). New York: Macmillan education. • Jain & Jain (2009). Fundamentals of Biochemistry. New Delhi: S. Chand. • U. Satyanarayana, U. a. (2019). Biochemistry (5th ed.). new delhi: RELX india and Books and Allied Pvt. Ltd.
e-learning resources	SWAYAM (https://swayam.gov.in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Undergraduate Program in Biotechnology (B. Sc.)
(3 Years Degree; 4 Years Honours/Honours with Research)

Semester-II: Course: BTP-MN-2: Practical

Course Code	BTP-MN-2
Course Title	**Practical**
Credit	2
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h X 1 day = 4 h
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	Course aims to provide students with a strong foundation in laboratory techniques and scientific methodology, enabling them to approach scientific investigations with confidence, precision, and a thorough understanding of the principles and techniques involved.
Course Objective	The objective of the course is to provide students with a comprehensive understanding of scientific methodology and laboratory techniques. It aims to develop their skills in experimental design, data collection, analysis, and interpretation. The course focuses on exploring various scientific phenomena, such as surface tension, buffer systems, and qualitative tests for carbohydrates, proteins, and lipids.
Course Outcomes	By the end of this course: • Students will understand the importance of formulating a hypothesis, collecting and analyzing data, and drawing conclusions based on the results obtained. • Participants will be proficient in measuring the surface tension of water and comparing it to solutions with varying concentrations. They will understand how solutes affect surface tension and be able to interpret the results obtained through experimental analysis. • Students will be able to plot a titration curve and determine the pKa value of a weak acid. They will understand the principles behind acid-base titrations and be able to analyze experimental data to obtain accurate pKa values. • Students will understand the concepts of buffering and be able to calculate the buffer capacity based on experimental measurements. • Participants will have a comprehensive understanding of buffer systems commonly found in biological systems. They will be able to identify and analyze the components of buffer systems, as well as their importance in maintaining pH stability in biological processes. • They will be familiar with various chemical reagents used in carbohydrate analysis and understand the principles behind these tests, enabling them to identify the presence of carbohydrates in different samples.

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They will possess the knowledge of specific reagents and techniques used in protein detection, allowing them to identify the presence of proteins in various samples.
They will understand the chemical reactions involved in lipid detection and be able to interpret the results obtained through these tests, enabling them to identify the presence of lipids in different samples.
Participants will be capable of determining various parameters such as acid value, iodine number, and saponification number. They will understand the principles behind these measurements and their significance in analyzing the quality and properties of oils and fats.
Participants will gain proficiency in protein estimation using methods such as Folin-Lowry, Bradford, and Bromo Cresol Green (BCG). They will be able to perform accurate protein estimations, and interpret the results obtained through these techniques.

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<tr><td>Mapping between COs with PSOs</td><td>
<table>
<tr><td></td><td>PSO 1</td><td>PSO 2</td><td>PSO 3</td><td>PSO 4</td><td>PSO 5</td><td>PSO 6</td><td>PSO 7</td><td>PSO8</td></tr>
<tr><td>CO 1-10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
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<tr><td>Pre-requisite</td><td>Basics of Biology, Biotechnology, Biochemistry, Microbiology</td></tr>
<tr><td>Course Content</td><td>
1. Scientific method introduction: Design and conduct a simple experiment to investigate a scientific question, including formulating a hypothesis, data collection and analysis.
2. Measure the surface tension of water and compare it with solutions of different concentrations, investigating the impact of solutes on surface tension.
3. Plot a titration curve and determine the pKa value of the weak acid.
4. Determining capacity of buffer solution.
5. Explore buffer systems commonly found in biological systems.
6. Qualitative test for carbohydrates.
7. Qualitative test for proteins.
8. Qualitative test for lipids.
9. Acid Value/Iodine Number/Saponification Number.
10. Folin-Lowry/Bradford/Bromo Cresol Green (BCG) method for protein estimation.
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<tr><td>Reference Books</td><td>

Patel, R. (2019) Experimental Microbiology vol 1 and vol 2, 5th ed. Aditya Publication.
Kamboj, P. C. (2008) University Practical Chemistry, Vishal Publishing Company, Punjab.
Aneja, K. R. (2014) Laboratory Manual of Microbiology and Biotechnology, MedTech, Scientific International Pvt. Ltd., New Delhi.

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<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>30% Internal assessment based on class attendance, participation, internal examination, etc. 70% External based onsemester end University examination</td></tr>
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