Re-Accredited 'B++' 2.86 CGPA by NAAC
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વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી
યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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ક્રમાંક :ઓથો./પરિપત્ર/૬૬૨૩/૨૦૨૫
તા.૧૭/૦૩/૨૦૨૫

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

વિષયઃ– NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગ અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગને મંજૂર કરવા અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૫ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૫</u>

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરી વિજ્ઞાનવિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ અન્વયે કરેલ ભલામણ સ્વીકારી NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર–I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

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 Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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 Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours)	(CCE) Internal Marks	(SEE) External Marks		
BT-MJ-101	Introduction to Biotechnology	3	01:30	37	38	75	3
BTP-MJ-101	Practical	2	03:00	13	12	25	1
	Total	**5**	**04:30**	**50**	**50**	**100**	**4**
BT-MJ-102	Cell Biology	3	01:30	37	38	75	3
BTP-MJ-102	Practical	2	03:00	13	12	25	1
	Total	**5**	**04:30**	**50**	**50**	**100**	**4**
	Total	10	09:00	100	100	200	8

Semester-II

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-MJ-201	Biochemistry of Water	3	01:30	37	38	75	3
BTP-MJ-201	Practical	2	03:00	13	12	25	1
	Total	**5**	**04:30**	**50**	**50**	**100**	**4**
BT-MJ-202	Biomolecules	3	01:30	37	38	75	3
BTP-MJ-202	Practical	2	03:00	13	12	25	1
	Total	**5**	**04:30**	**50**	**50**	**100**	**4**
	Total	10	09:00	100	100	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-101
Course Title	**Introduction to Biotechnology**
Course Level	100-199
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://ableindia.in/	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

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**	
Course Level	100-199	
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		
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	Teaching Hours:16

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

	required for mitotic movements, Cytokinesis, Meiosis- The stages of meiosis, Genetic recombination during meiosis. Various cell division mechanism in prokaryotes.	
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	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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-I: Course: BTP-MJ-101 & 102: Practical

Course Code	BTP-MJ-101 & 102
Course Title	**Practical**
Course Level	100-199
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.

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

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.

</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>
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</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>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
B. Sc. Medical Laboratory Technology
Minor Elective Course Structure of Semester I & II

SEMESTER – I							
Course Code	**Title of The Course**	**Course Credit**	**Hrs. Per Week**	**Internal Exam Marks (CCE)**	**External Exam Marks (SEE)**	**Total Marks**	**Duration of External Exam (Hr.)**
MLT-ME-101	Instruments and Equipments of Medical Laboratory	02	02	25	25	50	01
MLTP-ME-101	Practicals Based on Instruments and Equipments of Medical Laboratory	02	04	25	25	50	06
SEMESTER – II							
MLT-ME-201	Laboratory Specimens and Biomedical Waste Management	02	02	25	25	50	01
MLTP-ME-201	Practicals Based on Laboratory Specimens and Biomedical Waste Management	02	04	25	25	50	06

SEMESTER I

MLT-ME-101: INSTRUMENTS AND EQUIPMENTS OF MEDICAL LABORATORY

Semester: I	
Course Code	MLT- ME -101
Course Title	Instruments and Equipments of Medical Laboratory
Course Type	Minor
Credit	2
Course Level	100-199
Teaching Hour/ Week	2 Hours
Teaching Time	15×2= 30 Hours
Course Objectives	• This course equips students with the knowledge of different instruments used in a clinical laboratory. • It teaches students about the principle, working and applications of the various instruments. • It helps to understand the different types of laboratory glasswares, its cleaning and its calibration.
Course Outcome	At the end of the course, the students will get knowledge of **CO1 -** Component and use of basic laboratory instruments, Working Principle, components, operation and use of various sterilizing equipments like Autoclave, Hot air oven. **CO2 -** Different types of glasswares, plasticwares and other accessories used in clinical laboratory, its use, calibration and cleaning.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO1										
CO2										

Course Content:

Unit No.	Content	Teaching Hours
Unit-1	**Laboratory Instruments: Principle, Component, Use, Care and maintenance**	**15 Hr.**
1.1	pH meter	
1.2	Colorimeter	
1.3	Centrifuge	
1.4	Instruments of Sterilization: Autoclave and Hot Air Oven	
Unit-2	**Laboratory Equipments**	**15 Hr.**
2.1	Introduction to Laboratory wares: Glassware, Plastic wares and Accessories	
2.2	Calibration of Glassware	
2.3	Cleaning of Glassware	
2.4	Care and Maintenance of Glassware	

Reference Books:

Sr. No.	Title/Edition	Authors	Publisher
1	Textbook of Medical Laboratory Technology, 3rd Edition, Volume 1	Praful B. Godkar & Darshan B. Godkar	Bhalani Publishing House Mumbai, India
2	Medical Laboratory Technology - A Procedure Manual for Routine	Kanai L. Mukherjee	Tata Mc Graw -Hill Education Private Limited, New Delhi

	Diagnostic tests, Volume 1, 2nd Edition		
3	Medical Laboratory Science - Theory and Practice	K. Ochei & A Kolhatkar	Tata Mc Graw -Hill Publishing Limited Company, New Delhi
4	Elementary Microbiology, Fundamentals of Microbiology, Vol-1	H.A. Modi	Akta Prakashan, Nadiad
5	Prescott's Microbiology, 10th edition	Willey. J.M, Sherwood L.M and Woolverton C.J., (2017)	McGraw- Hill Education
6	Manual of Basic Techniques for a Health Laboratory	WHO	World Health Organization (2003)

MLTP-ME-101: PRACTICALS BASED ON INSTRUMENTS AND EQUIPMENTS OF MEDICAL LABORATORY

Semester: I	
Course Code	MLTP-ME-101
Course Title	Practicals Based on Instruments and Equipments of Medical Laboratory
Teaching Time	30×2=60 Hours
Course Objectives	• This course equips students with the knowledge of different instruments used in a clinical laboratory. • It teaches students about the principle, working and applications of the various instruments. It helps to understand the different types of laboratory glasswares, its cleaning and its calibration.
Course Outcome	At the end of the course, the students will able to understand in **CO1 to CO8 -** Identify and know the use of different glassware, know cleaning procedure as well as calibration of glassware, Operate various basic instruments and equipments of laboratory

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
CO 1-8										

Course Content

1. Study of Laboratory Glassware
2. Cleaning of Laboratory Glassware
3. Calibration of 1 ml, 5 ml pipette
4. Operation of pH meter
5. Measurement and adjustment of pH by pH meter.
6. Operation of colorimeter
7. Operation of Centrifuge
8. Sterilization by Hot air oven and autoclave

Reference Books:

Sr. No.	Title/Edition	Authors	Publisher
1	Textbook of Medical Laboratory Technology, 3rd Edition, Volume 1	Praful B. Godkar & Darshan B. Godkar	Bhalani Publishing House Mumbai, India
2	Medical Laboratory Technology - A Procedure Manual for Routine Diagnostic tests, Volume 1, 2nd Edition	Kanai L. Mukherjee	Tata Mc Graw -Hill Education Private Limited, New Delhi
5	Elementary Microbiology, Fundamentals of Microbiology, Vol-1	H.A. Modi	Akta Prakashan, Nadiad

MBP- ME-101

EUKARYOTIC CELL STRUCTURE PRACTICALS

1. Observation and examination of yeast cell.
2. Observation and examination of fungal cell.
3. Observation and examination of algal cell.
4. Observation and examination of protozoa.
5. Observation of different eukaryotic cells (permanent slides).
6. Staining of nuclear material.
7. Examination of cell organelles in paramecium.

Student Learning Outcomes:

- ✓ Students shall learn the structure and functions of cell wall and cell membrane as well as cytoplasm and nucleus.
- ✓ They will learn the structure and functions of varied cell organelles.

Recommended Learning Resources:

- Modi H. A., (2014), A Handbook of Elementary Microbiology, Shanti Prakashan, (ISBN: 978-93-5070-1010)
- Willey J., Sandman K. and Wood D., (2020), Prescott's Microbiology, 11th Edition, McGraw Hill, (978-1-260-57002-1)

MB-ME-102

ESSENTIAL OF BIOCHEMISTRY

1. Course description

Course Code: MB- ME-102
Course title: Essential of Biochemistry
Course type: Minor Elective
Course Credits: 02 + 02

2. Course Overview and Course objectives

The course includes the study of atoms and molecules and the solubility of compounds in the solution. It also covers the knowledge of acids and bases and the maintenance of pH. The course includes the understanding of biological compounds and the chemical reactions.

Course Objectives:

- ✓ To learn the fundamentals of atoms and molecules
- ✓ To study the solubility of compounds and its presence in solutions
- ✓ To understand acid and base and its role in pH maintenance
- ✓ To introduce biological compounds and its role in chemical reactions

3. Course Content

UNIT 1	BIOCHEMISTRY FOR MICROBIOLOGY
1.1	Atoms and molecules
1.2	Solubility of compounds
1.3	Concentration of compounds in solution
1.4	Acids, Bases and pH

UNIT 2	BIOCHEMICAL COMPOUNDS AND CHEMICAL REACTIONS
2.1	Important biological compounds
2.2	Introduction to chemical reactions
2.3	Ionization of water
2.4	Buffering against pH changes in biological systems
2.5	Water as reactant

MBP-ME-102

ESSENTIAL OF BIOCHEMISTRY PRACTICALS

1. Preparation of standard solutions.
2. Preparation of buffer solutions.
3. Adjustment of pH.
4. Preparation of molar solution
5. Preparation of molal solution
6. Preparation of normal solution.
7. Solubility test of compounds (Starch, gelatin, lipid).

4. Student Learning Outcomes:

- ✓ Students shall acquire knowledge of atoms and molecules, solubility of compounds and pH.
- ✓ They shall learn about important biological compounds and chemical reactions as well as the role of water as reactants.

Recommended Learning Resources:

- Satyanarayan U., and Chakrapani U., (2013), Biochemistry, Elsevier (9788131236017)
- Rodwell V. W., Bender D. A., Botham K. M., Kennelly P. J., Weil P. A., Harper's Biochemistry, McGraw Hill Education.
- Aneja K. R., (2007), Experiments in Microbiology, Plant Pathology and Biotechnology, New age International
- Godkar P. B., And Godkar P. D., (2003), Textbook of Medical Laboratory Technology, Bhalani Publishing House, Mumbai, India
- Mukherjee K. L., (1962), Medical Laboratory Technology- A procedure manual for routine diagnostic tests. McGraw Hill Education Pvt. Ltd. New Delhi.
- Pelczar M. J., Chan E.C.S Chan, Krieg N. R., (2011), Microbiology: An application-based approach, Tata McGraw Hill Education Private Limited.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty): Multidisciplinary Course

Teaching & Evaluation Scheme
Semester-I & II
[Academic Year of Implementation 2023-2024]

Semester-I

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-MDC-101	Basic Healthcare	4	2:00	50	50	100	4
	Total	**4**	2:00	**50**	**50**	**100**	**4**
BT-MDC-102	Introduction to Bioinformatics and Databases	4	2:00	50	50	100	4
	Total	**4**	2:00	**50**	**50**	**100**	**4**

Semester-II

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-MDC-201	Evolutionary Biology	4	2:00	50	50	100	4
	Total	**4**	2:00	**50**	**50**	**100**	**4**
BT-MDC-202	Environmental Biology and Wildlife	4	2:00	50	50	100	4
	Total	4	2:00	**50**	**50**	**100**	**4**
BT-MDC-203	Basics of Bioinformatics	4	2:00	50	50	100	4
	Total	**4**	2:00	50	50	100	**4**
BT-MDC-204	Bioinstrumentation	4	2:00	50	50	100	4
	Total	4	2:00	**50**	**50**	**100**	**4**

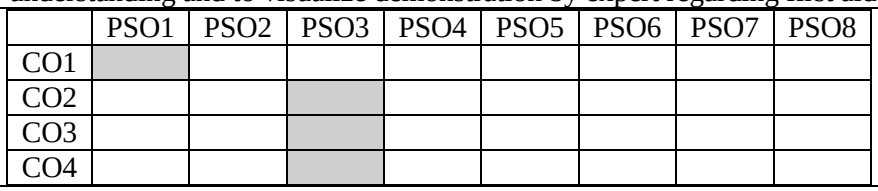
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-I

Multidisciplinary Course: BT-MDC-101: Basic Healthcare

Course Code	BT-MDC-101
Course Title	**Basic Healthcare**
Credits	4
Course Level	100-199
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	This course is for all students who wants to learn fundamental concepts related to self-care and care for others which gives them confidence to take immediate actions during emergencies. Basic health Care course orients learner to understand some important aspects to take care and steps in case of various types of health related emergencies.
Course Objectives	-To understand basic concepts of First aid, this can help to society as well as own self. -Person can deal with current emergency situation on quick base. -Knowledge of First aid can save life or may give temporary relief to prevent worst situation in absence of health professional. -It helps to realize moral duties and values.
Course Outcomes	CO1: Students will able to learn about primary aid skills. CO2: Student will deal to handle present emergency situation with confidence. Students will develop basic skill which is needed to assess the ill or injured person. CO3&4: Students will able to take logical decisions and shall be able to take appropriate immediate actions. Hospital visit is included for brief practical understanding and to visualize demonstration by expert regarding first aid.
Mapping between COs with PSOs	
Pre-requisite	Biology; Chemistry; Public Health; Ethics; Medical Terminology
Course Content	**UNIT-1: Preparing to Help (First Aid)** First Aid Techniques; Aim and The Law; Dealing with an Emergency; Stress when giving First Aid and Resuscitation; Primary and Secondary Assessment; Hygiene and Hand Washing. — Teaching Hours: 15 **UNIT-2: Medical Emergencies** Heart, Blood Circulation, Shock; GI tract, Diarrhoea, Food Poisoning and Diabetes; Respiratory System and Breathing; Nervous System and Unconsciousness; Urinary System, Reproductive System and Emergency Childbirth; Senses, Foreign Bodies in Eye, Ear, Nose or Skin and Swallowed Foreign Objects. — Teaching Hours: 15

	Unit 3: Injury Emergencies Control of Bleeding; Burns: Thermal, Electrical and Chemical; Head, Neck and Back injuries; Minor Injuries: Nosebleed, Injured Tooth; Wounds; Bones, Joints and Muscles.	Teaching Hours: 15
	UNIT-4: Environmental Emergencies Heat and Cold Emergencies; Bites and Stings; Poisoning and Poisonous Plants; Lightning; Emotional Considerations; Visits to Hospital.	Teaching Hours: 15
Reference Books	• Indian First Aid Manual (2016) 7th Edition, Indian Red Cross Society. • Basic First Aid, Student book, version 8.0, American Safety and Health Institute, ISBN 978-1-936515-64-6, 1st Edition (2016)	
e-learning resources	• https://www.indianredcross.org/publications/FA-manual.pdf • https://www.emcmedicaltraining.com/wp-content/uploads/2016/09/ashi-first-aid-student-book.pdf	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-I

Multidisciplinary Course: BT-MDC-102: Introduction to Bioinformatics and Databases

<table>
<tr><td>Course Code</td><td colspan="2">BT-MDC-102</td></tr>
<tr><td>Course Title</td><td colspan="2">Introduction to Bioinformatics and Databases</td></tr>
<tr><td>Credits</td><td colspan="2">4</td></tr>
<tr><td>Course Level</td><td colspan="2">100-199</td></tr>
<tr><td>Total engagement</td><td colspan="2">4 Credits x 15 Hours = 60 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="2">4 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="2">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="2">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="2">The purpose of the course is to give knowledge to the students regarding the fundamentals of bioinformatics and databases using computers.</td></tr>
<tr><td>Course Objectives</td><td colspan="2">Any use of tools and databases is based on bioinformatics. Biological databases are becoming more and more importance in today life for better knowledge.</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">CO1&2: The student will be able clarify the fundamentals of computer including applications, generations, components, hardware, softwares and networking.
CO3&4: The student will be able to get knowledge of basic bioinformatics and various biological databases.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="2">
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</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>
<tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>CO4</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="2">Biology; Chemistry; Computer Science</td></tr>
<tr><td>Course Content</td><td>UNIT-1: Computer Fundamentals - 1
Overview, Applications, Generations and its types; Components, CPU, Input Devices and Output Devices; Memory, RAM, ROM, Motherboard, Memory units and Ports.</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td>UNIT-2: Computer Fundamentals - 2
Hardware and Software; Number system, Number Conversion, Data and Information; Networking, Operating System, Internet and Intranet.</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td>UNIT-3: Introduction to Bioinformatics
What is Bioinformatics and its applications; Scope of Bioinformatics; Structure visualizing tools; Examples of related tools (FASTA, BLAST, RASMOL, SWISS PORT, Cn3D).</td><td>Teaching Hours: 15</td></tr>
<tr><td></td><td>UNIT-4: Biological Databases
General Introduction of Biological Databases; Nucleic acid databases (NCBI, GENBANK, PubMed, DDBJ and EMBL); Protein databases (PDB and MMDB); Structure databases (CATH, SCOP and PDBsum); Metabolic pathway databases (KEGG)</td><td>Teaching Hours: 15</td></tr>
</table>

Reference Books	• E. Balagurusamy (2009), *Fundamentals of Computers*, Tata McGraw Hill Education Private Limited, New Delhi, ISBN 13: 978-0-07-014160-5 • S. C. Rastogi (2018), *Bioinformatics Methods and Applications (Genomics, Proteomics and Drug Discovery)*, PHI Learning Private Limited, Delhi, ISBN 978-81-203-4785-4
e-learning resources	https://www.tutorialspoint.com/computer_fundamentals/index.htm https://www.ncbi.nlm.nih.gov/ https://www.embl.org/ https://www.rcsb.org/ https://www.cathdb.info/ https://scop.mrc-lmb.cam.ac.uk/ https://www.genome.jp/kegg/
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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

Undergraduate Program (Science Faculty):
Skill Enhancement Course

Teaching & Evaluation Scheme
Semester-I & II
[Academic Year of Implementation 2023-2024]

Semester-I

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-101	Bacteriological Media and Isolation Techniques	Theory 1	0:30	12	13	25	1
		Practical 2	3:00	13	12	25	1
	Total	**3**	**3:30**	**25**	**25**	**50**	**2**
BT-SEC-102	Study of Soil Profile	Theory 1	0:30	12	13	25	1
		Practical 2	3:00	13	12	25	1
	Total	**3**	**3:30**	**25**	**25**	**50**	**2**

Semester-II

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-201	Introduction to Staining Techniques	Theory 1	0:30	12	13	25	1
		Practical 2	3:00	13	12	25	1
	Total	**3**	**3:30**	**25**	**25**	**50**	**2**
BT-SEC-202	Aquarium Fish Rearing	Theory 1	0:30	12	13	25	1
		Practical 2	3:00	13	12	25	1
	Total	**3**	**3:30**	**25**	**25**	**50**	**2**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-I

Skill Enhancement Course: BT-SEC-101: Bacteriological Media and Isolation Techniques

Course Code	BT-SEC-101
Course Title	Bacteriological Media and Isolation Techniques
Credits	2 (1 credit theory & 1 credit practical)
Course Level	100-199
Total engagement	1 Credit x 15 Hours + 1 Credit x 30 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	This course will give students the introduction, necessity, composition and types of media, isolation techniques and practical skills regarding the preparation of culture media and other basic handling skills required in a lab.
Course Objectives	-To help understand the role of various nutrients in growth of organisms. -To create awareness regarding media preparation. - Types of media formed - Various techniques for the isolation of pure culture.
Course Outcomes	CO1: Students will gain knowledge about media, its ingredients, role, types and various techniques for isolation of pure culture. CO2: Students will gain skills regarding media preparation, cleaning and sterilizing of glassware and media, how to prepare a smear, how to stain a smear and how to perform serial dilution.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	12^{th} Pass with Biology & Chemistry	
Course Content	**UNIT-1: Nutritional requirements and cultivation media** Introduction to Nutritional requirement and chemical elements required, Steps in preparation of media, Introduction and Basal Ingredients of culture media, Types of media (Solid, Semi-solid and Liquid), Techniques for isolation of pure culture-Single cell, serial dilution, pour plate, streak plate and spread plate techniques.	Teaching Hours: 15
	UNIT-2: Practical 1. Preparation of Culture media (Solid, Semi-solid and Liquid). 2. Cleaning and Sterilization of glassware and media. 3. Preparation, fixation and monochrome staining of a smear. 4. Preparation of Serial dilution. 5. Demonstration of different isolation techniques.	Teaching Hours: 30

Reference Books	• Dubey, M. (2009) *Practical Microbiology*. New Delhi: S. Chand. • Srivastava, M. L. (2008) *Microbial Biochemistry.* Narosa Publishing House. • Madigan, B. B. (2019) *Brock Biology of Microorganisms* (5 ed.). Pearson. • Rakesh Patel, K. P. (2016) *Experimental Microbiology* (9 ed., Vol. I). Aditya Publication.
e-learning resources	https://www.youtube.com/dbtvnsgu
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-I

Skill Enhancement Course: BT-SEC-102: Study of Soil Profile

Course Code	BT-SEC-102
Course Title	Study of Soil Profile
Credits	2 (1 credit theory & 1 credit practical)
Course Level	100-199
Total engagement	1 Credit x 15 + 1 Credit x 30 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	This course is for all students who wants to learn fundamental concepts related to understand Formation of soil and Properties of soil. Also, to learn about soil organism correlation.
Course Objectives	- This paper is meant to make students understand the importance of soil in agriculture and soil science. - Student will know various physical and chemical properties of soil. Also, will know about soil biology soil microbes' interaction.
Course Outcomes	CO1: Students will able to define soil texture. CO2: They can identify soil types accordingly to texture characteristics. CO3: They can identify source of organic matter in soil. CO4: They will able to define soil pH. CO5: Identify types of soil organisms and their functions within a soil ecosystem.
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>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>
Pre-requisite	12th Pass with Biology and Chemistry
Course Content	**UNIT-1: Soil Profile** What is soil? Weathering-Formation of soil, Soil formation factors and processes, Soil Profile, Soil biology, Soil physical properties, Soil Structure and Consistency, Soil water, Concept of Soil pH and Nutrient Availability, Soil organic matter. — Teaching Hours: 15
	Practical: 1. Determination of Soil pH 2. Identification of soil texture- clay, sand, loamy by sieve method. 3. Identification of soil types-red soil, black soil. 4. Analysis of soil organic matter. 5. Microbiological analysis of soil (SPC/TVC) — Teaching Hours: 30
Reference Books	• Mehra, R. K. (2011). *Textbook of Soil Science*. Indian Council of Agricultural Research.

	• Brady, N. C., Weil, R. R., & Weil, R. R. (2008). *The nature and properties of soils* (Vol. 13, pp. 662-710). Upper Saddle River, NJ: Prentice Hall.
e-learning resources	• https://agrimoon.com/wp-content/uploads/Fundamentals-of-Soil-Science-with-Practicals.pdf • https://agrigyan.in/fundamentals-of-soil-science-pdf-download-free/#preview-download-pdf • https://www.agriexam.com/introduction-to-soil-science-book-pdf
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

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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E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

સંદર્ભ: (૧) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૧૬૩૪૫/૨૦૨૩, તા.૦૧/૦૭/૨૦૨૩
(૨) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૧૫૪૨/૨૦૨૩, તા.૧૮/૦૮/૨૦૨૩
(૩) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૩૧૫૪/૨૦૨૩, તા.૦૪/૦૯/૨૦૨૩

-: પરિપત્ર :-

વાણિજય વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, NEP 2020 અંતર્ગત શિક્ષણ વિભાગના તા.૧૧/૦૭/૨૦૨૩ ના ઠરાવ અન્વયે,શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર અંગ્રેજી વિષયના F.Y.B.Com.Sem- 1 & 2 ના AEC અને SEC ના અભ્યાસક્રમના પ્રશ્નપત્રના માળખા અને ગુણોની ફાળવણીમાં જરૂરી સુધારા વધારા અંગે અંગ્રેજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિવતી મંજૂર કરી વાણિજય વિદ્યાશાખાને કરેલ ભલામણ વાણિજય વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વાણિજય વિદ્યાશાખાવતી વાણિજય વિદ્યાશાખાના અધરધેન ડીનશ્રીએ મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૭/૦૮/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંકઃ ૯૯ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા ઉપરોકત પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૩૧૫૪/૨૦૨૩, તા.૦૪/૦૯/૨૦૨૩ થી જાણ કરવામાં આવેલ છે.

વધુમાં શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર અંગ્રેજી વિષયના F.Y.B.Com.Sem- 1, 2 & 3 ના Multidisciplinary ના અભ્યાસક્રમ અને પ્રશ્નપત્રના માળખાને અંગ્રેજી વિષયની અભ્યાસ સમિતિ વતી અંગ્રજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ મંજૂર કરી વાણિજય વિદ્યાશાખાને કરેલ ભલામણ વાણિજય વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વાણિજય વિદ્યાશાખા વતી વાણિજય વિદ્યાશાખાનાં અધરધેન ડીનશ્રીએ મંજૂર કરેલ છે જેમાં F.Y.B.Com.Sem- 1, 2 & 3 ના Multidisciplinary ના અભ્યાસક્રમ એકેડેમિક કાઉન્સિલની તા.૧૭/૦૮/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨૨ થી મંજૂર કરેલ છે. અને પ્રશ્નપત્રનું માળખું એકેડેમિક કાઉન્સિલની તા.૭/૦૮/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૯ થી એકેડેમિક કાઉન્સિલ વતી મંજૂર કરવા આપેલ સત્તાની રૂએ માનનીય કુલપતિશ્રી ધ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/૨૩૯૭૪/૨૦૨૩
તા. ૧૪–૦૯–૨૦૨૩

કુલસચિવ

પ્રતિ,
૧) વાણિજય વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોના આચાર્યશ્રીઓ,
..... આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વાણિજય વિદ્યાશાખા,
૩)પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ.ગુ.યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
NEP – 2020 GUIDED

SYLLABUS FOR ABILITY ENHANCEMENT COURSE (AEC)

ENGLISH PROFICIENCY AND LIFE SKILLS- I & II

FOR B.A/ B.COM. /B.SC. (REGULAR) SEMESTER I
FOR THE ACADEMIC YEARS 2023-24 TO 2025-26

B.A./ B.COM. /B.SC. SEM 1 : TEXT : ***English and Soft Skills*** **by S P Dhanavel (OB)**

Course Code	
Course Title	ENGLISH PROFICIENCY AND LIFE SKILLS - I
Credit	2
Teaching per-Week	2 hours
Minimum weeks per Semester	15 (including class work, examination, preparation, holidays etc.)
Effective From	July 2023
Purpose of Course	To prepare the young graduates for the job market today by boosting their linguistic competency and soft skills .
Course Objective	CO1: To encourage the all round development of students by focusing on Soft Skills . CO2 : To develop and nurture the Soft Skills of the students through individual and group activities. CO3 : To expose students to write attitudinal and behavioral aspects and build the same through various tasks and activities.
Course Outcomes	After completing the course the students would have : CO1: understood of what Soft Skills is . CO2: understood the significance of Soft Skills in the working environment. CO3: developed levels in their ability through soft skills.
Mapping between COs with PSOs	
Pre-requisite	Acquaintance with basic grammar and language skills

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1					
CO2					
CO3					

Dr.G.K.NANDA

Course Content	**TEXTBOOK: *English and Soft Skills* by S P Dhanavel (Orient Blackswan)** • Ch. 1.Listening Skills • Ch. 2.Teamwork Skills • Ch. 3.Emotional Intelligence Skills • Ch. 6.Problem – Solving Skills **Note 1.** Understanding the Story ,Vocabulary and Grammar ,Thinking about Soft Skills, Soft Skills from the Story, Proverbs on the Skills ,Soft Skills at workplace, Real life experiences -- these sections from the exercises are to be prepared for the Internal and University Exams. **2.** Understanding People , Places and events , Activity ,Self Assessment -- these sections may be used for homework/ Assignments for the holistic development of students.
Reference Books	1. *Building Soft Skills for Employability* by Tran Le Huu Nghia (Routledge) 2. *Soft Skills* by M. S. Rao (Motivational Press) 3. *Personality Development and Soft Skills* by Sikha Kapoor (Dreamtech Press) 4. *Soft Skills for Success* by G.R.K. Murty (Viva)
Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Test marks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination.

Dr.G.K.NANDA

Distribution of Marks for the University Examination as per NEP SOP

Q 1. MCQ from Understanding the Story (4/5)	04 Marks
Q 2. Case Study or Real life experience (1/2)	07 Marks
Q 3. **A.** Short answer type questions (2/4) 04 Marks (To be asked from 'Thinking about Soft Skills 'and 'Soft Skills at the Work Place') **B.** Expansion of an idea/ Proverb relating to soft skills (1/2) 03 Marks	07 Marks
Q 4. Grammar and Vocabulary (7/10)	07 Marks
Total	25 Marks

Dr.G.K.NANDA

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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

યુનિવર્સિટી ડિપાર્ટમેન્ટનાં વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ તથા યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર હિન્દુ સ્ટડીઝ અભ્યાસ સમિતિની તા.૨૭/૦૫/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ થી VACહેઠળ મંજૂર કરેલ Bharatiya Knowledge System - an Introduction (BKS) Sem-1નો રિવાઈઝ અભ્યાસક્રમ અંગે વિચારણા કરતા એકેડેમિક કાઉન્સિલની તા.૧૫/૦૮/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૮ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૧૫/૦૮/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૮

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર હિન્દુ સ્ટડીઝ અભ્યાસ સમિતિની તા.૨૭/૦૫/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ થી VAC હેઠળ મંજૂર કરેલ Bharatiya Knowledge System - an Introduction (BKS) Sem-1નો રિવાઈઝ અભ્યાસક્રમ મંજૂર કરવામાં આવે છે. તથા સેમે.–૧ માં ફરજીયાત પણે સદર અભ્યાસક્રમનો અમલ કરવાનો રહેશે, અન્ય વિકલ્પ આપી શકાશે નહી.

(બિડાણ : ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/૧૨૮૦૦/૨૦૨૪
તા. ૧૯–૦૮–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ,
૨) યુનિવર્સિટી ડિપાર્ટમેન્ટના વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
૪) કો–ઓર્ડિનેટરશ્રી, IKS Centre - Centre for Hindu Studies, વી. ન. દ. ગુ. યુનિ. સુરત.

..... જાણ તથા ઘટતું થવા.

એકેડેમિક કાઉન્સિલ તા. 15-06-2024
બાબત....૧૪.....બિડાણ/પરિશિષ્ટ.....16.....

Veer Narmad South Gujarat University Surat
Year:2024-25
Course: Bharatiya Knowledge Systems –an Introduction Semester: 1
Credits: 2, Hours: 40

યુનિટ	વિષય
૧	➢ ભારતનાં સ્વ નો સાક્ષાત્કાર . ➢ ગૌરવશાળી ભારત અને તેની જ્ઞાનપરંપરા. ➢ ભારતીય સંસ્કૃતિ અને જ્ઞાન પરંપરાનો વિશ્વસંચાર. ➢ ભારતનું વિશ્વને યોગદાન અને ભારતનાં વિજ્ઞાનની ઉજવળ પરંપરા.
૨	➢ ભારતીય વિચારનું વૈશિષ્ટ અને જીવનદૃષ્ટિ . ➢ ભારતીય જ્ઞાન પરંપરાની પ્રમુખ વિભાવનાઓ. ▪ પુનર્જન્મ ,કર્મનો સિદ્ધાંત ,સુખની અવધારનાં. ➢ ભારતીય જ્ઞાન પરંપરામાં સામાજીક દૃષ્ટિ. ▪ સહઅસ્તિત્વ ,ઉપાસનાનું વૈવિધ્ય ,પ્રકૃતિ અંગેના વિચાર. વસુધૈવ કુટુંબકમની વિભાવનાં અને' સર્વેભવંતું સુખીન'

ઉદ્દેશ્યો

- વિદ્યાર્થીઓમાં ભારતીય જ્ઞાન પ્રણાલીના પરિપ્રેક્ષ્ય ની સમજ કેળવાય અને તેના વિશે સ્વીકૃતિ નો ભાવ કેળવાય.
- વિદ્યાર્થીઓને ભારતના મૂળભૂત સત્વ નો ખ્યાલ સ્પષ્ટ થાય અને ભારતીય અસ્મિતા શું છે તેનાથી પરિચિત કરવા.
- આપણાં પરંપરાગત જ્ઞાન અને તેના ખ્યાલની સમજ કેળવવી.
- ભારતીય જ્ઞાન પ્રણાલી પર ચર્ચા, વિચારોનું આદાન-પ્રદાન અને જોડાણ માટે પ્લેટફોર્મ પૂરું પાડવા માટે.
- સમાજ અને શિક્ષણમાં ભારતીય જ્ઞાન પ્રણાલીઓની સમકાલીન સુસંગતતા અને આવશ્યકતા વિશે જાગ્રત કરવા.
- સમાજ અને શિક્ષણમાં ભારતીય જ્ઞાન પ્રણાલીઓની સમકાલીન સુસંગતતા અને આવશ્યકતા વિશે જાગ્રત કરવા.
- ભારતીય જ્ઞાનનાં રક્ષણની જરૂરિયાત વિષે અને તેનાં મહત્વને જાણવા પ્રત્યે સંવેદનશીલ માનસ કેળવવુ.

અધ્યયન નિષ્પત્તિ

- વિદ્યાર્થીઓમાં ભારતીય જ્ઞાન પ્રણાલીની મૂળભૂત બાબતોની સમજ અને કેળવાશે તથા તેની સુસંગતતા અને વિવિધ ક્ષેત્રોમાં તેની ઉપયોગીતા વિષયક જાગૃતિ આવશે.
- આ અધ્યયન સંબંધિત શૈક્ષણિક શાખાઓનાં ભાવી સંશોધનોમાં અને તેની વર્તમાન ઉપયોગીતામાં પણ પ્રેરણારૂપ થશે.
- IKS, વિદ્યાર્થીના સર્જનાત્મક કૌશલ્યને તથા નવિનનતમ વિચારને પ્રેરીત કરશે.
- વધુમાં, તે વિદ્યાર્થીઓને તેમનો આત્મવિશ્વાસ વધારવામાં મદદ કરશે.
- આ અધ્યયન દ્વારા વિદ્યાર્થી વધુ ખુલ્લા મન થી વિચારતો થશે તથા તેનામાં વધેલા આત્મવિશ્વાસથી તેમની સૌંદર્યલક્ષી સર્જનાત્મકતામાં વધારો થશે.

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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT.

BKS Syllabus for all UG Programmes Semester-1

Designed by,

Centre For Hindu Studies

भारतीय ज्ञान संपोषण केन्द्रम्,

वीर नर्मद दक्षिण गुजरात यूनिवर्सिटी, सूरत.

Veer Narmad South Gujarat University Surat

Year: 2024-25

Course: Bharatiya Knowledge Systems –an Introduction Semester: 1

Credits: 2, Hours: 30

Unit -1	**Bharatiya Knowledge Systems and Tradition**
	➢ Self – Revelation of Bharat. ➢ Knowledge Tradition of Glorious Bharat. ➢ The Sublime Journey of Bharatiya Culture & Civilization. ➢ Dissemination and contribution of Bharatiya Knowledge systems in the world Glorious tradition of Science and Art in Bharat.
Unit -2	**The Way of Life/ Jivan Darshan in Bharatiya Knowledge Systems**
	➢ Way of life as Bharatiya Knowledge Systems. ➢ The Implicit Concepts in Bharatiya Knowledge Systems. Birth, Death, Rebirth, Law of Karma, Idea of Sukhha, ➢ Social Viewpoint in Bharatiya Knowledge systems. ➢ Co - existence of Nature and Human Nature, Manifold Paths of Upasana, Value co-Existence- Ritam. ➢ Idea of Vasudhaivkutumbkam.

Objectives

- To uphold perspective and reception of the Indian knowledge system among the students.
- To acquaint students to the real essence of Bharat and what is actually Bharatiya Asmita.
- To cultivate the understanding of the concept of traditional knowledge and its importance among the students.

- To provide a platform for discussion, exchange of ideas, and engagement on the Indian knowledge system.
- To explore the contemporary relevance and application of Indian knowledge systems in society and academia.
- Creating sensitivity towards knowing the need and importance of protecting traditional knowledge.

Outcomes

- Students will have an understanding of the basics of the Indian knowledge system and its relevance and applications to various fields.
- This will ideally also inspire future research and applications of these systems in their respective academic disciplines.
- IKS can enhance a student's creative skills by allowing them to inculcate novel thought process.
- Additionally, it will help the students build their self-confidence.
- It will enhance their aesthetic creativity by nurturing them to be more open-minded and confident.

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Re-Accredited 'B++' 2.86 CGPA by NAAC
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University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક :ઓથો./પરિપત્ર/૬૬૨૩/૨૦૨૫
તા.૧૭/૦૩/૨૦૨૫

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

વિષયઃ– NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગ અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગને મંજૂર કરવા અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૫ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૫</u>

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરી વિજ્ઞાનવિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ અન્વયે કરેલ ભલામણ સ્વીકારી NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર–I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

પ્રતિ,
૧) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા,
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VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program

In

Biotechnology

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

Program Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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 (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**
Course Level	100-199
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	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

Undergraduate Program in Biotechnology (B. Sc.)

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

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

<table>
<tr><td>Course Code</td><td colspan="2">BT-MJ-202</td></tr>
<tr><td>Course Title</td><td colspan="2">Biomolecules</td></tr>
<tr><td>Course Level</td><td colspan="2">100-199</td></tr>
<tr><td>Credit</td><td colspan="2">3</td></tr>
<tr><td>Total engagement</td><td colspan="2">3 Credits x 15 Hours = 45 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="2">3 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="2">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="2">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="2">To give students basic idea regarding biomolecules</td></tr>
<tr><td>Course Objective</td><td colspan="2">Students will know the basics about Biomolecules</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">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="2">
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</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>
<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="2">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>Reference Books</td><td colspan="2">

• Cox, D. N. (2017). Lehninger Principles of Biochemistry (7th ed.). New York: Macmillan education.
• Jain & Jain (2009). Fundamentals of Biochemistry. New Delhi: S. Chand.

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

	• 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	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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-II: Course: BTP-MJ-201 & 202: Practical

Course Code	BTP-MJ-201 & 202
Course Title	**Practical**
Course Level	100-199
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

<table>
<tr><td></td><td>tests, enabling them to identify the presence of carbohydrates in different samples.
• 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>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.</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>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

Undergraduate Program (Science Faculty): Minor Elective

Teaching & Evaluation Scheme

Semester-I & II

[Academic Year of Implementation 2023-2024]

Semester-I

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-ME-101	Basics of Biochemistry	2	01:00	25	25	50	2
BTP-ME-101	Practical	4	06:00	25	25	50	2
	Total	**6**	07:00	**50**	**50**	**100**	**4**
BT-ME-102	Ecological Studies	2	01:00	25	25	50	2
BTP-ME-102	Practical	4	06:00	25	25	50	2
	Total	**6**	07:00	**50**	**50**	**100**	**4**

Semester-II

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-ME-201	Water Footprint	2	01:00	25	25	50	2
BTP-ME-201	Practical	4	06:00	25	25	50	2
	Total	**6**	07:00	**50**	**50**	**100**	**4**
BT-ME-202	Introduction to Developmental Biology	2	01:00	25	25	50	2
BTP-ME-202	Practical	4	06:00	25	25	50	2
	Total	**6**	07:00	**50**	**50**	**100**	**4**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Minor Elective: BT-ME-201: Water Footprint

Course Code	BT-ME-201
Course Title	**Water Footprint**
Credits	2
Course Level	100-199
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	This course on "Water Footprint" aims to educate undergraduate science students on the intricacies of human-induced water consumption. By exploring the fundamentals of water footprint assessment, environmental impacts, and management strategies, students will gain a holistic understanding of the role of water in various sectors.
Course Objectives	1. Establish foundational knowledge on water footprint concepts and assessment tools. 2. Analyse the environmental impact of water use in agriculture, industry, and daily life. 3. Explore international water policies, governmental roles, and corporate responsibilities. 4. Investigate advanced topics such as water footprint in energy production and biodiversity implications. 5. Apply theoretical knowledge through practical projects and assessments.
Course Outcomes	CO1: Upon completion, students will possess a comprehensive understanding of water footprint dynamics, enabling them to assess and contribute to sustainable water management. CO2: They will develop critical thinking and problem-solving skills through hands-on projects, preparing them to address contemporary and future challenges related to water scarcity and environmental sustainability. The course equips students to become informed advocates for responsible water use in their scientific pursuits and broader societal roles.
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>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>
Pre-requisite	Biology, Environmental Science
Course Content	**UNIT-1: Fundamentals of Water Footprint** Introduction to Water Footprint, Water Footprint Assessment Tools, Environmental Impact of Water Use, Water Footprint in Daily Life, Water Footprint Policies and Management — Teaching Hours:15 **UNIT-2: Advanced Topics and Applications** Water Footprint in Energy Production, Water Footprint and Biodiversity, Future Challenges and Solutions, Group Projects and Presentations, Assessment and Evaluation — Teaching Hours: 15
Reference Books	• Arjen Y. Hoekstra, Ashok K. Chapagain, Maite M. Aldaya and Mesfin M. Mekonnen (2011) The Water Footprint Assessment Manual, Earthscan [ISBN: 978-1-84971-279-8] • M. M. Mekonnen and A. Y. Hoekstra (2011) National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and

	Consumption, UNESCO-IHE Institute of Water Education, Netherlands. • Winne Gerbens-Leenes, Arjen Y. Hoekstra and Theo H. van der Meer (2009) The water footprint of bioenergy, PNAS, Vol. 106, No. 25, 10219-10223.
e-learning resources	• https://www.chaitanyaproducts.com/blog/water-footprints-india-2019-is-it-sustainable/ • https://www.waterfootprint.org/water-footprint-2/what-is-a-water-footprint/
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

Minor Elective: BTP-ME-201 Practical

Course Code	BTP-ME-201
Course Title	**Practical: Water Footprint**
Credits	2
Course Level	100-199
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	The Water Footprint Practical Course is designed to provide undergraduate science students with practical, hands-on experiences related to water footprint assessment and management. The course aims to deepen students' understanding of the impact of human activities on water resources and instil practical skills to address water-related challenges.
Course Objective	The Water Footprint Practical Course aims to equip undergraduate science students with hands-on skills and knowledge in water footprint assessment and management. Through practical exercises, students will gain proficiency in using calculators, conducting field analyses, and proposing sustainable solutions. The course fosters critical thinking about the environmental impact of human activities on water resources, empowering students to contribute to sustainable water management globally.
Course Outcomes	Upon completion of the Water Footprint Practical Course, students will: 1. Acquire proficiency in using water footprint calculators, enhancing quantitative analysis skills. 2. Demonstrate a comprehensive understanding of water use in agriculture and propose sustainable irrigation practices. 3. Apply water audit techniques to assess and improve industrial water management strategies. 4. Evaluate the water footprints of food products, making informed choices for personal and environmental sustainability. 5. Understand the environmental impact of the textile industry and recommend sustainable alternatives.

<table>
<tr><td></td><td>6. Compare and contrast the water footprints of energy sources, promoting awareness of renewable energy benefits.
7. Conduct biodiversity assessments and propose conservation measures for water ecosystems.
8. Simulate and analyse water scarcity scenarios, developing a holistic understanding of resource challenges.
9. Evaluate corporate water management practices, fostering an understanding of corporate responsibility.
10. Design, implement, and present water footprint reduction projects, showcasing practical problem-solving and communication skills.</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>Biology, Environmental Science</td></tr>
<tr><td>Course Content</td><td>
1. Water Footprint Calculator Exploration (6 hours):
• Introduce students to various water footprint calculators.
• Guide them through the process of calculating personal and household water footprints.
• Discuss and compare results to understand the impact of daily activities.
2. Agricultural Water Use Analysis (6 hours):
• Conduct a field visit to a local farm or agricultural area.
• Measure and analyse water use in irrigation systems.
• Discuss sustainable agricultural practices to reduce water footprints.
3. Industry/Domestic/Corporate Water Audit (8 hours):
• Collaborate with local Institute/Organization for a water audit.
• Calculate the water footprint.
• Propose water-saving measures and assess their feasibility.
4. Food Consumption and Water Footprint (6 hours):
• Analyse food products' water footprints using life cycle assessments.
• Evaluate the impact of dietary choices on personal water footprints.
• Discuss strategies for sustainable and water-efficient food consumption.
5. Textile Industry Water Footprint (6 hours):
• Investigate water usage in the textile industry.
• Calculate the water footprint of a specific textile product.
• Explore textile sector to reduce water footprints.
6. Renewable Energy vs. Water Footprint (8 hours):
• Study the water footprints of different energy sources.
• Compare renewable and non-renewable energy options.
• Analyse the environmental implications of energy choices.
7. Biodiversity and Water Ecosystem Study (8 hours):
• Conduct a field visit to a local water ecosystem.
• Assess the impact of human activities on biodiversity.
</td></tr>
</table>

	• Propose measures to conserve water ecosystems and their biodiversity. **8. Water Scarcity Simulation (4 hours):** • Simulate water scarcity scenarios using a computer model. • Analyse the socio-economic impacts of water scarcity. • Discuss strategies for mitigating water scarcity challenges. **9. Corporate Water Footprint Analysis (6 hours):** • Collaborate with a local company for a water footprint analysis. • Evaluate corporate water management practices. • Suggest improvements for reducing the company's overall water footprint. **10. Water Footprint Reduction Project (8 hours):** • Divide students into groups to design water footprint reduction plans. • Implement projects based on real-world scenarios or hypothetical situations. • Present and discuss the effectiveness of the proposed solutions.
Reference Books	• Arjen Y. Hoekstra, Ashok K. Chapagain, Maite M. Aldaya and Mesfin M. Mekonnen (2011) The Water Footprint Assessment Manual, Earthscan [ISBN: 978-1-84971-279-8] • M. M. Mekonnen and A. Y. Hoekstra (2011) National Water Footprint Accounts: The Green, Blue and Grey Water Footprint of Production and Consumption, UNESCO-IHE Institute of Water Education, Netherlands. • Winne Gerbens-Leenes, Arjen Y. Hoekstra and Theo H. van der Meer (2009) The water footprint of bioenergy, PNAS, Vol. 106, No. 25, 10219-10223.
e-learning resources	• https://www.chaitanyaproducts.com/blog/water-footprints-india-2019-is-it-sustainable/ • https://www.waterfootprint.org/water-footprint-2/what-is-a-water-footprint/
Teaching Methodology	Laboratory work, Journal preparation
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
Undergraduate Program (Science Faculty)
(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II
Minor Elective: BT-ME-202: Introduction to Developmental Biology

Course Code	BT-ME-202
Course Title	**Introduction to Developmental Biology**
Credit	2
Course Level	100-199
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	Developmental biology is a branch of biology that focuses on understanding how multicellular organisms develop from a single fertilized egg (zygote) into complex, organized structures with specialized functions. The purpose of developmental biology is to study and elucidate the processes that govern the growth, differentiation, and morphogenesis of organisms throughout their life cycles.
Course Objective	The objective of a developmental biology course is to provide students with a deep understanding of the intricate processes that govern how organisms develop from a single fertilized egg into complex, functional structures. Throughout this course, students delve into the fundamental principles of embryogenesis, cell differentiation, and organ formation.
Course Outcomes	CO1: Students will acquire the knowledge the stages of development from fertilization through adulthood, and identify the factors and events that influence each stage CO2: Understanding of the key concepts and principles in plant developmental biology.
Mapping between COs with PSOs	See table below
Pre-requisite	Basic Science
Course Content	**UNIT-1: An Introduction to Early Developmental Processes** Cleavage, Patterns of cleavage: Holoblastic cleavage and Meroblastic cleavage, Gastrulation, Axis-formation — Teaching Hours:15 **UNIT-2: Basic concepts of plant development** Plant Life Cycles, Gamete Production in Angiosperms, Pollen Structure, The ovary, Pollination, Fertilization, Seed Dormancy, Seed Germination. — Teaching Hours:15
Reference Books	• Gilbert S. F. (2011). Developmental Biology 9th Edition. Sinauer Associates. ISBN: 978-0878933846 • Twyman, R. M. (2003). Developmental Biology. Bios Scientific. ISBN 978-8176492379
e-learning resources	• https://plato.stanford.edu/entries/biology-developmental/ • https://www.britannica.com/science/biological-development

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

Minor Elective: BTP-ME-202: Practical

Course Code	BTP-ME-202
Course Title	**Practical: Introduction to Developmental Biology**
Credits	2
Course Level	100-199
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation, holidays etc.)
Effective from	2023-2024
Purpose of Course	To provide undergraduate students with the opportunity to observe and understand the processes involved in the development of animal and plant. Hands-on experiments and observations allow students to witness developmental stages, morphological changes in real-time.
Course Objective	Course objectives for a Plant and Animal Development course typically aim to provide students with a comprehensive understanding of the principles, processes, and mechanisms involved in the growth and development of plants and animals. These objectives aim to provide students with a solid foundation in the principles of plant and animal development, from molecular mechanisms to the organismal level, while also fostering practical skills and an appreciation for the diversity of developmental processes in the biological world.
Course Outcomes	Upon completion of the developmental biology Practical Course, students will: 1. Understand the depth that how media preparation will be done and importance of each component present in media 2. Students will acquire the knowledge of how plant will grow from undifferentiated cell under the laboratory conditions. 3. This experiment allows students to explore the impact of temperature conditions on seed germination and seedling development, providing valuable insights into the role of temperature in plant growth. 4. Students to explore the impact of light conditions on seed germination and seedling development, providing valuable insights into the role of light in plant growth. 5. This experiment allows students to explore the impact of pH conditions on seed germination and seedling development, providing valuable insights into the role of pH in plant growth. 6. Students to draw conclusions, and discuss the factors affecting seed dormancy based on their experimental results. This hands-on approach provides a practical understanding of seed dormancy and the factors influencing seed germination. 7. Students will explore the principles and study their life cycles and

<table>
<tr><td></td><td>observe developmental changes at different stages in C. elegans/Zebra Fish/ Chick embryo/Human Embryo.
8. The students will be able to study cleavage pattern in model organism Frog.
9. Permanent slides serve as valuable resources for education, research, and the ongoing exploration of the complexities of developmental biology.</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>Basic Science</td></tr>
<tr><td></td><td>1. To study media preparation for plant development studies.
2. To study callus culture.
3. Seed germination: Experiments on seed germination under different temperature conditions
4. Seed germination: Experiments on seed germination under different light conditions
5. Seed germination: Experiments on seed germination under different pH conditions
6. To study seed dormancy.
7. To determine Developmental stages in C. elegans/Zebra Fish/ Chick embryo/Human Embryo (demonstration)
8. To study different type of cleavage in frog.
9. To study permeant slides (ovaries and sperm)</td></tr>
<tr><td>Reference Books</td><td>• Pandey, B. P. (1999). Modern Practical Botany-Volume II. S. Chand Publishing.
• Kumar, U., & Kumar, U. (2011). Methods in plant tissue culture. Agrobios (India).</td></tr>
<tr><td>e-learning resources</td><td>• https://www.sciencedirect.com/science/article/abs/pii/S2214786122000341
• https://academic.oup.com/aob/article/101/2/293/185992</td></tr>
<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Multidisciplinary Course: BT-MDC-201: Evolutionary Biology

Course Code	BT-MDC-201
Course Title	**Evolutionary Biology**
Credit	4
Course Level	100-199
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	4 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 Evolutionary biology: Some theories of Evolution, Direct-indirect Evidences of Evolution & regarding population ecology.
Course Objective	The course will stand on its utility towards learning and implementing the aspects towards Evolutionary Biology.
Course Outcomes	The student at the completion of the course will be able to CO1: Understand the Theories of Lamarckism; Neo-Lamarckism, Theory of Natural Selection, Modern Synthetic Theory, Weismann's Germ Plasm Theory, Mutation Theory CO2: To be familiar with fossils & also know about the geological time-table. CO3: Students will acquire detailed knowledge of Indirect evidences of Evolution. CO4: To understand about population ecology.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

Pre-requisite	Fundamental Biology	
Course Content	**UNIT-1: Theories of Organic Evolution** Theories of Inheritance of Acquired Character: Lamarckism; Neo-Lamarckism, Theory of Natural Selection, Modern Synthetic Theory, Weismann's Germ Plasm Theory, Mutation Theory	Teaching Hours:15
	UNIT-2: Direct Evidences of Evolution: Fossils Palaeontological Evidences, Fossils, Nature and Types of Fossils, The Geological Time Table	Teaching Hours:20

	UNIT-3: Indirect Evidences of Evolution Evidences from Comparative Anatomy: Connecting Link; Homology; Analogy; Vestigial Organs, Evidences from Comparative Embryology, Evidences from Comparative Physiology and Biochemistry	Teaching Hours:15
	UNIT-4: Population Ecology Population Characteristics, Vital Index and Survival Curves, Population Dynamics, Growth Rate, Population Dispersion	Teaching Hours:10
Reference Books	P. S. Verma and V, K Agarwal (2010) Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, *S. Chand Publication*, ISBN 81-219-2442-1.	
e-learning resources	• https://www.britannica.com/science/evolution-scientific-theory • http://www.researchgate.net/publication/335339827_Life _Sciences_Fundamentals_and_Practce_Vol_II_Seventh_Edition	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Multidisciplinary Course: BT-MDC-202: Environmental Biology and Wildlife

<table>
<tr><td>Course Code</td><td colspan="2">BT-MDC-202</td></tr>
<tr><td>Course Title</td><td colspan="2">Environmental Biology and Wild life</td></tr>
<tr><td>Credits</td><td colspan="2">4</td></tr>
<tr><td>Course Level</td><td colspan="2">100-199</td></tr>
<tr><td>Total engagement</td><td colspan="2">4 Credits x 15 Hours = 60 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="2">4 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="2">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="2">2023-2024</td></tr>
<tr><td>Purpose of Course</td><td colspan="2">The course "Environmental Biology and Wildlife" is designed to provide students with a comprehensive understanding of the interconnections between living organisms and their natural environment.</td></tr>
<tr><td>Course Objectives</td><td colspan="2">Through this course, students will explore the intricate relationships and ecological processes that shape the delicate balance of ecosystems. By merging principles from biology and ecology, students will develop a holistic perspective on environmental and the importance of wildlife diversity.</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">CO1: Students will be able to learn about scope and objectives of ecology.
CO2: Students will learn about conservation of natural resources.
CO3: Students will be familiar with different sources of energy.
CO4: Students will acquire knowledge of wild life conservation and its importance.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="2">
<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>
<tr><td>CO4</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="2">Biology; Chemistry; Public Health; Ethics; Medical Terminology</td></tr>
<tr><td rowspan="3">Course Content</td><td>UNIT-1: Ecology and Environment
Definition and objectives of ecology, Subdivisions of ecology, Scope of ecology, Structural, Functional and Evolutionary concepts of ecology.</td><td>Teaching Hours: 10</td></tr>
<tr><td>UNIT-2: Ecology and Human Welfare
Conservation of natural resources, Energy and its conservation, Food, Agriculture and Aquaculture, Forestry.</td><td>Teaching Hours: 15</td></tr>
<tr><td>UNIT-3: Resources and energy
Introduction, Solar energy, wave and wind power, liquid hydrogen, energy plantations, liquid fuels from waste, biogas technology, biological conversion of waste.</td><td>Teaching Hours: 15</td></tr>
</table>

	UNIT-4: Wild-life Management Wild life of India, Reasons for depletion of wild life, Necessity for wild life conservation, Modes of wild life conservation, Conservation of flora and fauna-endangered species and forest resources.	Teaching Hours: 20
Reference Books	1. Verma PS and Agarwal PK (2015). Environmental Biology, S. Chand Publications, New Delhi. 2. Subrahmanyam NS and Sambamurty AVSS (2008). Ecology (Second Edition), Narosa Publishing House, New Delhi.	
e-learning resources	Biosphere (nationalgeographic.org)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

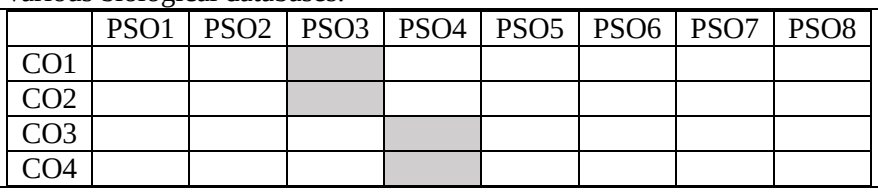
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Multidisciplinary Course: BT-MDC-203: Basics of Bioinformatics

Course Code	BT-MDC-203	
Course Title	**Basic of Bioinformatics**	
Credits	4	
Course Level	100-199	
Total engagement	4 Credits x 15 Hours = 60 Hours	
Teaching per week	4 h	
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)	
Effective from	2023-2024	
Purpose of Course	The purpose of the course is to give knowledge to the students regarding the fundamentals of computer and bioinformatics.	
Course Objectives	Any use of tools and databases is based on bioinformatics. Biological databases are becoming more and more importance in today life for better knowledge.	
Course Outcomes	CO1&2: The student will be able clarify the fundamentals of computer including applications, generations, components, hardware, softwares and networking. CO3&4: The student will be able to get knowledge of basic bioinformatics and various biological databases.	
Mapping between COs with PSOs		
Pre-requisite	Biology; Chemistry; Computer Science	
Course Content	**UNIT-1: HTML** Introduction to HTML, Working of HTML, Creating and loading HTML pages, tags, Structure of on HTML, Document, Stand Alone Tags, formatting text, Adding Images, Creating hyper Links, Tables.	Teaching Hours: 15
	UNIT-2: MS Office MS-Word: Introduction, Starting MS-Word Screen and its Components, Elementary Working with MS-Word. MS-Excel: Introduction, Starting MS-Excel, Basics of Spreadsheet, MS- Excel Screen and its Components, Elementary Working with MS-Excel. MS-Power Point: Introduction, Starting MS-PowerPoint, Basics of PowerPoint, MS-PowerPoint Screen and its Components, Elementary Working with MS-PowerPoint.	Teaching Hours: 15
	UNIT-3: Pair-Wise Sequence Alignment Sequence Alignments, its types and importance. Method of Sequence Alignment - Dot Matrix Analysis, Dynamic Programming Methods (Local alignment and Global alignment), Heuristic Methods.	Teaching Hours: 15
	UNIT-4: Multiple Sequence Alignment Introduction and Application of Multiple Sequence Alignment. Methods of Multiple Sequence Alignment - Sum of Pair Method,	Teaching Hours: 15

	Progressive Alignment Method (Clustalw), Iterative Alignment Method. Gap penalty - its types and significance.	
Reference Books	• E. Balagurusamy (2009), *Fundamentals of Computers*, Tata McGraw Hill Education Private Limited, New Delhi, ISBN 13: 978-0-07-014160-5 • S. C. Rastogi (2018), *Bioinformatics Methods and Applications (Genomics, Proteomics and Drug Discovery)*, PHI Learning Private Limited, Delhi, ISBN 978-81-203-4785-4	
e-learning resources	https://www.tutorialspoint.com/computer_fundamentals/index.htm https://www.ncbi.nlm.nih.gov/ https://www.embl.org/ https://www.rcsb.org/ https://www.cathdb.info/ https://scop.mrc-lmb.cam.ac.uk/ https://www.genome.jp/kegg/	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

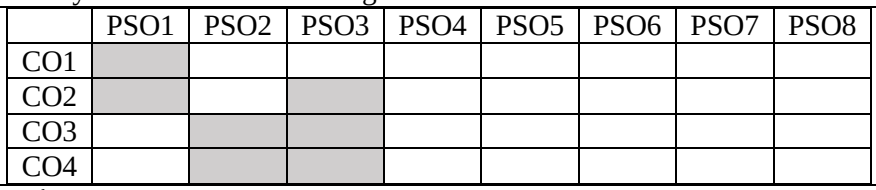
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Multidisciplinary Course: BT-MDC-204: Bioinstrumentation

Course Code	BT-MDC-204
Course Title	**Bioinstrumentation**
Credits	4
Course Level	100-199
Total engagement	4 Credit x 15 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	The course aims to provide basic knowledge to students pursuing careers in Life Sciences, Biotechnology, Microbiology and healthcare. Additionally, the course fosters an interdisciplinary approach, showcasing how the integration of various instruments and techniques contributes to a deeper understanding of biological systems
Course Objectives	The course on Bioinstrumentation aims to provide students with a foundational understanding of various instruments and techniques used in the field of Biology. The students will learn basic principles of Microscopy and different Analytical techniques.
Course Outcomes	CO1: Students will learn, basics of Microscopy and different types of Microscopes. CO2: Students will be introduced to different analytical techniques, which are widely used for research biological sciences
Mapping between COs with PSOs	
Pre-requisite	12th Pass with Basic Science.
Course Content	**UNIT-1: Basic Microscopy** Principles of Microscopy, Magnification, resolving power, numerical aperture. Working principle and applications of Bright field microscope, Dark field microscope, Phase contrast microscope and DIC microscope. Preparation and staining of specimen. — Teaching Hours: 15
	UNIT-2: Advanced Microscopy Working principle and applications of Fluorescence microscope, Confocal microscope, Electron microscope - TEM and SEM, Specimen preparation for SEM and TEM. — Teaching Hours: 15
	UNIT-3: Introduction to chromatography Introduction and working principles of paper chromatography, liquid chromatography, affinity chromatography and gas chromatography. — Teaching Hours: 15

	UNIT-4: Introduction to centrifugation Sedimentation, Centrifugal force, principle and working of centrifuge, different types of centrifuges, types of rotors used in centrifuge.	Teaching Hours: 15
Reference Books	• Keith Wilson & John Walker (ED) (2000) Practical biochemistry- Principle and Techniques. Cambridge University Press. • Robards K, Haddad P.R & Jackson P.E (1994) Principles and practice of modern chromatographic methods, Academic press London. • Willey, J. M., Sherwood, L. M., & Woolverton, C. J. (2008). Prescott, Harley, and Klein's microbiology. McGraw-Hill.	
e-learning resources	Techniques of Materials Characterization - Course (nptel.ac.in)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Skill Enhancement Course: BT-SEC-201: Introduction to Staining Techniques

Course Code	BT-SEC-201	
Course Title	**Introduction to Staining Techniques**	
Credits	2 (1 credit theory & 1 credit practical)	
Course Level	100-199	
Total engagement	1 Credit x 15 Hours + 1 Credit x 30 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	This course will give students the introduction of stains, different staining methods, special staining and how to visualize different types of microbial structure. Also will help to develop practical skills to handle, stain and visualize microbes using microscope.	
Course Objectives	- To understand various types of staining techniques - To create awareness regarding how each technique differs from other - Techniques used for differentiation of microbes - Techniques for visualization of different structures in microbes and fungus.	
Course Outcomes	CO1: Students will gain knowledge about stains, different staining techniques, how to differentiate between microbes, staining techniques to observe structures in microbes and fungus. CO2: Students will gain skills regarding stain preparation, bacterial staining & differentiation, and staining of internal structures.	
Mapping between COs with PSOs		
Pre-requisite	Biology; Chemistry.	
Course Content	**UNIT-1: Introduction to Staining Techniques** Introduction and types of staining techniques (direct, indirect, progressive, regressive, vital, monochrome, differential, structural, impregnation), Differential staining (Gram stain, Acid fast stain), Special staining (Cell wall, Capsule, Endospore), Staining of fungus (Lacto phenol Cotton Blue Wet mount), Staining of Nucleus (Giemsa, Feulgen).	Teaching Hours: 15
	UNIT-2: Practical 1. Negative staining. 2. Gram's staining of microbial culture. 3. Acid fast staining by Ziehl-Neelson method. 4. Cell wall staining. 5. Capsule staining.	Teaching Hours: 30

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

	6. Endospore staining. 7. Nucleus staining.	
Reference Books	• Anderson, D., Salm, S., Allen, D., & Nester, E. (2016). *Nester's Microbiology- A Human Perspective* (8th ed.). McGraw Hill Education. • Aneja, K. (2014). *Laboratory Manual of Microbiology and Biotechnology* (1st ed.). MedTech. • Dubey, M. (2009) *Practical Microbiology*. S.CHAND. • Patel, R., & Patel, K. (2022). *Lecture notes on Introduction to Microbiology*. Aditya Publication. • Patel, R., & Patel,K P. (2016) *Experimental Microbiology* (9 ed., Vol. I). Aditya Publication.	
e-learning resources	https://www.youtube.com/dbtvnsgu	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-II

Skill Enhancement Course: BT-SEC-202: Aquarium Fish Rearing

Course Code	BT-SEC-202
Course Title	**Aquarium Fish Rearing**
Credits	2 (1 credit theory & 1 credit practical)
Course Level	100-199
Total engagement	1 Credit x 15 Hours +1 Credit x 30 Hours = 45 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2023-2024
Purpose of Course	This course is for all Students will be able to know the fundamentals of aquarium fish industry. Also, to understand the biological features of aquarium fishes.
Course Objectives	- This paper is meant to make students will be able to know the fundamentals of different aquarium fishes. - Student will get to know the food and feeding habits of aquarium fishes. Also, will get aware about transportation of fishes.
Course Outcomes	CO1: Students will manage the home as well as public (commercial) aquariums, learn to handle different aquarium tools accessories. CO2: To determine appropriate species of fishes and plant life to be introduced into an aquarium and prepare the proper dosage of different kinds of natural and synthetic fish feed. Also, will identify common health problems with fish in an aquarium
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	Introduction to Aquarium Fish Keeping; Fresh water and Marine Aquarium fishes; Food and Feeding of Aquarium Fishes: Fish Transportation	
Course Content	**UNIT-1:** Introduction to Aquarium Fish Keeping, Construction, setting and maintenance of aquaria (Fabrication: frame - glass, size, Aquarium accessories: Heaters, thermostat, aerators, water filters etc). Water quality and fish health management (Abiotic components, Biotic components, Aquarium plants: Rooted, Branched, Floating. Aquarium fish diseases symptoms and treatment), Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as (Molly, Sword tail, Gold fish, Angel fish, blue morph, Anemone fish and Butterfly fish), Food and Feeding of Aquarium Fishes, Fish Transportation and Maintenance	Teaching Hours: 15
	Practical: **1.** Setting up of an aquarium. **2.** Comparative estimation of amount of DO, NH_3 in water samples. **3.** Study of different ornamental fishes-both fresh and marine water. **4.** Study of different Aquarium fish diseases. **5.** Visit of aquarium	Teaching Hours: 30

Reference Books	• "Aquarium Fish" by Andrew cleave • "Ornamental Fish Culture and Aquarium Management" by A.D. Dholakia, Daya Publishing House
e-learning resources	• https://www.vet-ebooks.com/encyclopedia-of-aquarium-and-pond-fish/ • https://kvknorthgoa.icar.gov.in/fishdb/pub/TB69.pdf
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

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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E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

સંદર્ભ: (૧) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૧૬૩૪૫/૨૦૨૩, તા.૦૧/૦૭/૨૦૨૩
(૨) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૧૫૪૨/૨૦૨૩, તા.૧૮/૦૮/૨૦૨૩
(૩) યુનિવર્સિટી પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૩૧૫૪/૨૦૨૩, તા.૦૪/૦૯/૨૦૨૩

-: પરિપત્ર :-

વાણિજય વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોના આચાર્યશ્રીઓને જણાવવાનું કે, NEP 2020 અંતર્ગત શિક્ષણ વિભાગના તા.૧૧/૦૭/૨૦૨૩ ના ઠરાવ અન્વયે,શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર અંગ્રેજી વિષયના F.Y.B.Com.Sem- 1 & 2 ના AEC અને SEC ના અભ્યાસક્રમના પ્રશ્નપત્રના માળખા અને ગુણોની ફાળવણીમાં જરૂરી સુધારા વધારા અંગે અંગ્રેજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિવતી મંજૂર કરી વાણિજય વિદ્યાશાખાને કરેલ ભલામણ વાણિજય વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વાણિજય વિદ્યાશાખાવતી વાણિજય વિદ્યાશાખાના અધરધેન ડીનશ્રીએ મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૦૭/૦૮/૨૦૨૩ ની સભાના ઠરાવ ક્રમાંકઃ ૯૯ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય કુલપતિશ્રી દ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા ઉપરોકત પરિપત્ર ક્રમાંકઃએસ./પરિપત્ર/૨૩૧૫૪/૨૦૨૩, તા.૦૪/૦૯/૨૦૨૩ થી જાણ કરવામાં આવેલ છે.

વધુમાં શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી અમલમાં આવનાર અંગ્રેજી વિષયના F.Y.B.Com.Sem- 1, 2 & 3 ના Multidisciplinary ના અભ્યાસક્રમ અને પ્રશ્નપત્રના માળખાને અંગ્રેજી વિષયની અભ્યાસ સમિતિ વતી અંગ્રજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ મંજૂર કરી વાણિજય વિદ્યાશાખાને કરેલ ભલામણ વાણિજય વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વાણિજય વિદ્યાશાખા વતી વાણિજય વિદ્યાશાખાનાં અધરધેન ડીનશ્રીએ મંજૂર કરેલ છે જેમાં F.Y.B.Com.Sem- 1, 2 & 3 ના Multidisciplinary ના અભ્યાસક્રમ એકેડેમિક કાઉન્સિલની તા.૧૭/૦૮/૨૦૨૩ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨૨ થી મંજૂર કરેલ છે. અને પ્રશ્નપત્રનું માળખું એકેડેમિક કાઉન્સિલની તા.૭/૦૮/૨૦૨૩ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૯ થી એકેડેમિક કાઉન્સિલ વતી મંજૂર કરવા આપેલ સત્તાની રૂએ માનનીય કુલપતિશ્રી ધ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/૨૩૯૭૪/૨૦૨૩
તા. ૧૪–૦૯–૨૦૨૩

કુલસચિવ

પ્રતિ,
૧) વાણિજય વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોના આચાર્યશ્રીઓ,
..... આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વાણિજય વિદ્યાશાખા,
૩)પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ.ગુ.યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
NEP – 2020 GUIDED

SYLLABUS FOR ABILITY ENHANCEMENT COURSE (AEC)

ENGLISH PROFICIENCY AND LIFE SKILLS- II

FOR B.A/ B.COM. /B.SC. (REGULAR) SEMESTER II
FOR THE ACADEMIC YEARS 2023-24 TO 2025-26

B.A./ B.COM. /B.SC. SEM 2 : TEXT : ***English and Soft Skills*** **by S P Dhanavel (OB)**

Course Code	
Course Title	ENGLISH PROFICIENCY AND LIFE SKILLS- II
Credit	2
Teaching per Week	2 hours
Minimum weeks per Semester	15 (including class work, examination, preparation, holidays etc.)
Effective From	July 2023
Purpose of Course	To prepare the young graduates for the job market today by boosting their linguistic competency and soft skills .
Course Objective	CO1: To encourage the all round development of students by focusing on Soft Skills . CO2 : To develop and nurture the Soft Skills of the students through individual and group activities. CO3 : To expose students to write attitudinal and behavioral aspects and build the same through various tasks and activities.
Course Outcomes	After completing the course the students would have : CO1: understood of what Soft Skills is . CO2: understood the significance of Soft Skills in the working environment. CO3: developed levels in their ability through soft skills.
Mapping between COs with PSOs	
Pre-requisite	Acquaintance with basic grammar and language skills

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1					
CO2					
CO3					

Dr.G.K.NANDA

Course Content	**TEXTBOOK:** ***English and Soft Skills*** **by S P Dhanavel (Orient Blackswan)** • Ch. 4. Assertive Skills • Ch. 5. Learning Skills • Ch. 8. Adaptability Skills • Ch. 9. Non – Verbal Communication Skills **Note 1.** Understanding the Story ,Vocabulary and Grammar ,Thinking about Soft Skills, Soft Skills from the Story, Proverbs on the Skills ,Soft Skills at workplace, Real life experiences – these sections from the exercises are to be prepared for the Internal and University Exams. **2.** Understanding People , Places and events , Activity ,Self Assessment – these sections may be used for homework/ Assignments for the holistic development of students.
Reference Books	5. *Building Soft Skills for Employability* by Tran Le Huu Nghia (Routledge) 6. *Soft Skills* by M. S. Rao (Motivational Press) 7. *Personality Development and Soft Skills* by Sikha Kapoor (Dreamtech Press) 8. *Soft Skills for Success* by G.R.K. Murty (Viva)
Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Test marks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination

Distribution of Marks for the University Examination as per NEP SOP

Q 1. MCQ from Understanding the Story(4/5)	04 Marks
Q 2. Case Study or Real life experience (1/2)	07 Marks
Q 3. A. Short answer type questions (2/4) 04 Marks (To be asked from 'Thinking about Soft Skills 'and 'Soft Skills at the Work Place') B. Expansion of an idea/ Proverb relating to soft skills (1/2) 03 Marks	07 Marks
Q 4. Grammar and Vocabulary (7/10)	07 Marks
Total	25 Marks

Dr.G.K.NANDA

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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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

સંદર્ભ:–(૧) યુનિવર્સિટી કાર્યાલયનાં તા.૦૯/૦૧/૨૦૨૪, પરિપત્ર ક્રમાંક : એસ./પરિપત્ર/૭૦૩/૨૦૨૪

–: પરિપત્ર :–

યુનિવર્સિટી ડિપાર્ટમેન્ટનાં વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ તથા યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૩–૨૪ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર Bhartiya Knowledge System (BKS) અંતર્ગત Hindu Studies પ્રોગ્રામ માટે નિયુકત એડહોક બોર્ડ / અભ્યાસ સમિતિની તા.૨૮/૧૨/૨૦૨૩ ની સભા દ્વારા VAC હેઠળ તૈયાર કરેલ Value Education in Bhartiya Knowledge System (BKS) સેમે–૨ નો અભ્યાસક્રમ એકેડેમિક કાઉન્સિલની તા.૦૯/૦૧/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૩૩ થી VAC બાસ્કેટ હેઠળ મંજૂર કરવામાં આવેલ છે.

વધુમાં, એકેડેમિક કાઉન્સિલની તા.૧૯/૦૧/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૦૧ થી સદર કોર્સ સંલગ્ન તમામ કોલેજ/વિભાગે સ્નાતક કક્ષાના અભ્યાસક્રમોમાં(એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાયના) સેમેસ્ટર–૨ માં ફરજીયાત પણે વિદ્યાર્થીઓને **VAC** હેઠળ આપવાનું ઠરાવવામાં આવેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંક : એસ./પરિપત્ર/૧૬૪૯/૨૦૨૪
તા.૧૯–૦૧–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ,
૨) યુનિવર્સિટી ડિપાર્ટમેન્ટના વડાશ્રીઓ. અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
૪) કો–ઓર્ડિનેટરશ્રી, IKS Centre - Centre for Hindu Studies, વી. ન. દ. ગુ. યુનિ. સુરત.

..... જાણ તથા ઘટતું થવા.

એકેડમિક કાઉન્સિલ તા. 06/01/2024
આઇટમ નં. 3.3 વિદ્યાપરિષદ નં. 10

Value Education in Bhartiya Knowledge System

Semester : 2

Course Title : Value Education in Bhartiya Knowledge System	
Course Code:	**No. of Cerdits:**02
Learning Hours:02 Hours /Week	
Course Type: ~~Core~~ VAC	
Offered in Academic Year :2023-24	

Objectives:

1. The main objective of this course is to stimulate ethical reflection, awareness, responsibility, and compassion in young students .
2. To provide them with insight into important ethical principles and values.
3. To equip them with intellectual capacities for responsible moral Judgment.
4. To cultivate not just knowledgeable individuals but also morally upright citizens who contribute positively to society.

Outcomes:

After completing this course the students would be able to meet the following Outcomes.

1. The learners would develop a strong sense of right and wrong.
2. The course would promote qualities such as honesty, patriotism, integrity and empathy
3. This qualities could not only contribute to their personal growth but also would contribute for building a harmonious and compassionate society.

Unit -1

1. Moral Stories : 1.The Story of the Blue Jackal (from Panchtantra)
2. The Brahmin and the Crooks (from Panchtantra)
3. Satyakama : The seeker of Truth (from Chandogya Upanishad)
4. Shvetaketu(fromChandogya Upanishad)
5. Little Prince No – Father (The Power of Truth) (from Jataka Katha)
6. Dirty Bath Water (from Jataka Katha)

Unit -2

(A)

- **Yamas and Niyamas** (Patanjali's Yoga Sutras)(Only introductory explainations required relating to **Five Yamas**– Ahimsa, Satya, Asteya, Brahmacharya, Aparigraha and **Five Niyamas** – Saucha, santosha, Tapas, Swadhyaya and Ishvara Pranidhana)

(B)

Subhashitani

1. एकवर्ण यथा दुग्धं भिन्नवर्णासु धेनुषु ।
   तथैव धर्मवैचित्र्यं तत्त्वमेकं परं स्मृतम् ॥
2. अयं निजः परो वेति गणना लघुचेतसाम् ।
   उदारचरितानां तु वसुधैव कुटुम्बकम् ॥
3. कुलस्यार्थे त्यजेदेकम् गाम्स्यार्थे कुलम्त्यजेत् ।
   गामं जनपदस्यार्थे आत्मार्थे पृथिवीम् त्यजेत् ।।
4. उद्यमेन हि सिध्यन्ति कार्याणि न मनोरथैः ।
   न हि सुप्तस्य सिंहस्य प्रविशन्ति मुखे मृगाः ।।
5. सत्यं ब्रुयात् प्रियम् बुयान्नब्रुयात् सत्यमप्रियम्
   प्रियम् च नानृतम् बुयादेषः धर्मः सनातनः ॥
6. असतो मा सद्गमय तमसो मा ज्योतिर्गमय
   मृत्योर्मा अमृतं गमय । बृहदारण्यक उप.
7. कः कालः कानि मित्राणि को देशः को व्ययागमौ ।
   कस्याहं का च मे शक्तिः इति चिन्त्यं मुहुर्मुहुः ॥
8. नमन्ति फलिनो वृक्षाः नमन्ति गुणिनो जनाः ।
   शुष्ककाष्ठश्च मूर्खश्च न नमन्ति कदाचन ॥
9. अपि स्वर्णमयी लंका न मे रोचति लक्ष्मण ।
   जननीः जन्मभूमिश्च स्वर्गादपि गरियसी ।
10. न राज्यं न राजाऽऽसीत् न दण्डयो न च दाण्डिकः ।
    धर्मेणैव प्रजास्सर्वा रक्षन्त स्म परस्परम् ॥

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક :ઓથો./પરિપત્ર/૬૬૨૩/૨૦૨૫
તા.૧૭/૦૩/૨૦૨૫

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

વિષયઃ– NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગ અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગને મંજૂર કરવા અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૫ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૫</u>

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરી વિજ્ઞાનવિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ અન્વયે કરેલ ભલામણ સ્વીકારી NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર–I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

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 Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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-III & IV

[Academic Year of Implementation 2024-2025]

Semester-III

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-MJ-301	Basics of Phytophysiology	2	01:00	25	25	50	2
BTP-MJ-301	Basics of Phytophysiology: Practical	4	06:00	25	25	50	2
	Total	**6**	**07:00**	**50**	**50**	**100**	**4**
BT-MJ-302	Fundamentals of Genetics	2	01:00	25	25	50	2
BTP-MJ-302	Fundamentals of Genetics: Practical	4	06:00	25	25	50	2
	Total	**6**	**07:00**	**50**	**50**	**100**	**4**
BT-MJ-303	Applications of Statistical Methods in Biology-I	4	02:00	50	50	100	4
	Total	**4**	**02:00**	**50**	**50**	**100**	**4**
	Total	16	16:00	150	150	300	12

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-III: Course: BT-MJ-301: Basics of Phytophysiology

Course Code	BT-MJ-301
Course Title	**Basics of Phytophysiology**
Course Level	200-299
Credit	2
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	This course provides a comprehensive understanding of plant physiology, covering fundamental mechanisms such as the C3, C4, and CAM cycles, photorespiration, and the roles of macro and micronutrients and phytohormones. Undergraduate students will gain insights into how plants utilize sunlight, minerals and hormones to support growth and development.
Course Objective	-Understand the mechanisms of photophosphorylation and their role in plant growth and development. -Comprehend the significance of carbon fixation and related biochemical pathways. -Gain awareness of the importance of micro and macro nutrients in plant physiology. -Acquire knowledge about the physiological roles of various plant hormones.
Course Outcomes	CO1: Demonstrate an understanding of the mechanisms of photophosphorylation and their impact on plant growth and development. Explain the significance of carbon fixation and related biochemical pathways in plants. CO2: Identify and describe the roles of macro and micronutrients in plant physiology. Analyse the physiological roles of various plant hormones and their effects on plant processes. Apply knowledge of plant physiology to observe and interpret the growth and development of plants in practical settings.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	Biology	
Course Content	**UNIT-1: Metabolic Mechanisms** 1.1 Utilization of Sunlight (Photophosphorylation) 1.2 C3 Cycle 1.3 C4 Cycle 1.4 CAM Cycle & Photorespiration	Teaching Hours: 15
	UNIT-2: Minerals & Hormones 2.1 Macro nutrients: Role & deficiency	Teaching Hours: 15

	2.2 Micro nutrients: Role & deficiency 2.3 Phyto hormones: Physiological role of Auxins, Kinetin, Gibberellins, ABA & Ethylene. 2.4 Water potential, Solute potential turgor pressure DPD osmotic potential, vital theories of water and minerals uptake. Donann equilibrium including sodium potassium pump.	
Reference Books	• Frank B. Salisbury and Cleon W. Ross (2010). Plant Physiology, Cengage learning products, India Edition. • S. N. Pandey and K. K. Singh, Plant Physiology, Vikas Pub.	
e-learning resources	• (PDF) Interaction Between Macro- and Micro-Nutrients in Plant (researchgate.net) • **(PDF) Introduction to plant physiology, 4th edition, By William Hopkins**	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

Semester-III: Course: BTP-MJ-301: Practical

Course Code	BTP-MJ-301
Course Title	**Basics of Pytophysiology: Practical**
Course Level	200-299
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	2024-2025
Purpose of Course	To provide undergraduate students with the opportunity to observe and understand the Physiology and chemistry of plants. Hands-on experiments and observations allow students to witness the morphological changes in real-time.
Course Objective	Course objectives for a Plant physiology course typically aim to provide students with a comprehensive understanding of the principles, processes, and mechanisms involved in the growth and development of plants. These objectives aim to provide students with a solid foundation in the principles of plant development.
Course Outcomes	Upon completion of the developmental biology Practical Course, students will: CO1: Understand the stomatal structure and number of stomata in plant leaf. CO2: Students will acquire the knowledge of principle Paper chromatography and how it is used to separate plant pigments and allows students to estimate Chlorophyll a, Chlorophyll b and total Chlorophyll content in plant leaf sample. CO3: Students will acquire the practical knowledge of osmotic potential

<table>
<tr><td></td><td>of plant.
CO4: Students to draw conclusions, and discuss the four-leaf method to determine the loss of water.
CO5: Students will compare the C3 and C4 plants anatomical studies.
CO6: The students will be able to study how carbon dioxide affect the photosynthesis process.
CO7: This experiment allows students to explore the impact of Micro and macronutrients on plants and their deficiency.
CO8: Students will demonstrate the Arc auxanometer and its function in measurement of plant growth.
CO9: Students will study the assembly of Wilmott’s bubbler and its role in determination of photosynthetic ability of plants.
CO10: Students will be able to characterize plant hormones.</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</td></tr>
<tr><td>Course Content</td><td>1. To find out stomatal frequency and transpiration index of leaf.
2. To separate the leaf pigments by paper chromatography technique and to estimate chlorophyll content of given plant leaf sample.
3. Determination of Osmotic potential of cell sap by plasmolytic method.
4. To compare the loss of water from two surfaces of leaf by Four leaf method.
5. Comparatively anatomical studies of C3 and C4 plants.
6. Effect of carbon dioxide concentration on the rate of photosynthesis.
7. To study the effect of macro and micro nutrients on plant.
8. To measure the rate of plant growth using Arc Auxanometer.
9. To determine the rate of photosynthesis by using Wilmott’s bubbler.
10. Estimation of plant hormone by spectrophotometric method.</td></tr>
<tr><td>Reference Books</td><td>• Pandey, B. P. (1999). Modern Practical Botany-Volume II. S. Chand Publishing.
• Jain, V. K. (2018). Fundamentals of Plant Physiology. S. Chand Publishing.
• (PDF) Measurement of stomatal density and stomatal index on leaf/plant surfaces (researchgate.net)
• (PDF) Interaction Between Macro- and Micro-Nutrients in Plant (researchgate.net)</td></tr>
<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-III: Course: BT-MJ-302: Fundamentals of Genetics

<table>
<tr><td>Course Code</td><td colspan="3">BT-MJ-302</td></tr>
<tr><td>Course Title</td><td colspan="3">Fundamentals of Genetics</td></tr>
<tr><td>Course Level</td><td colspan="3">200-299</td></tr>
<tr><td>Credit</td><td colspan="3">2</td></tr>
<tr><td>Total engagement</td><td colspan="3">2 Credits x 15 Hours = 30 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="3">2 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">2024-2025</td></tr>
<tr><td>Purpose of Course</td><td colspan="3">The purpose of the course is to give knowledge to the students regarding the fundamentals of genetics.</td></tr>
<tr><td>Course Objective</td><td colspan="3">The objective is to explain students about inheritance pattern of characters from one generation to another.</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">The student at the completion of the course will be able to
CO1: Students would be able to get details of Mendelian principles, inheritance pattern and its extensions as applied to study pedigrees.
CO2: Students would get insights about Chromosomes, their role in inheritance, linkage, recombination and mapping techniques.</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>
</table>
</td></tr>
<tr><td>Pre-requisite</td><td colspan="3">Biology</td></tr>
<tr><td rowspan="2">Course Content</td><td>UNIT-1: MENDEL’S PRINCIPLES OF INHERITANCE & ITS EXTENSIONS
Mendel’s Study of Heredity (Monohybrid & Dihybrid Crosses), Applications of Mendel’s Principles, Pedigree analysis (Autosomal recessive & Dominant disorders, X-Linked dominant & Recessive disorders, Y-linked inheritance, Hardy-Weinberg Law), Allelic variation and Gene Function, Gene Action, Sex-Linked Genes in Human beings, Sex Chromosome and Sex determination.</td><td>Teaching Hours: 15</td></tr>
<tr><td>UNIT-2: CYTOGENETICS, LINKAGE & CHROMOSOME MAPPING
Chromosomes, Chromosome theory of heredity, Sex-linked genes in Human beings, Sex chromosome & sex determination, Cytological techniques, Polyploidy, Aneuploidy, Rearrangements, Linkage, Recombination and Crossing Over, Chromosome and Cytogenetic Mapping</td><td>Teaching Hours: 15</td></tr>
<tr><td>Reference Books</td><td colspan="3">• D. Peter Snustad and Michael J. Simmons: Principles of Genetics, Wiley: John Wiley & Sons, Inc ISBN- 978-0-471-72597-8</td></tr>
</table>

	• A. F. Griffiths, S. R. Wessler, R. C. Lewontin and S. B. Caroll (2008) Introduction to Genetic Analysis, W. H. Freeman and Company, New York
e-learning resources	SWAYAM (https://swayam.gov.in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

Semester-III: Course: BTP-MJ-302: Practical

Course Code	BTP-MJ-302
Course Title	**Fundamental of Genetics: Practical**
Course Level	200-299
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	2024-2025
Purpose of Course	The purpose of the course is to familiarize students with handling practical problems related to genetics.
Course Objective	The objective is to perform practical based on Mendelian inheritance and other chromosomal abnormalities.
Course Outcomes	CO1&2: Apply knowledge of Mendelian inheritance patterns using model organism Drosophila. CO3&4: Examine and identify different stages of the cell cycle. CO5: Prepare and analyse slides to observe various stages of cell division. CO6to10: Understand banding patterns to identify abnormalities and will be able to conduct pedigree analysis justifying the understanding of inheritance patterns.
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 and Biochemistry
Course Content	1. Contribution of scientists in the field of genetics. 2. Identification of Eye colour in *Drosophila.* 3. Study of permanent slides of different stages of mitosis. 4. Study of permanent slides of different stages of meiosis. 5. To study meiosis by smear preparation of anthers. 6. Study of different chromosomal banding techniques. 7. Identification of abnormalities through karyotype. 8. Problems related to Mendelian genetics. 9. Pedigree analysis of human genetic disorders. 10. Demonstration of Giant (Polytene/Lampbrush) Chromosome in *Drosophila* salivary glands/ *Chironomous* Larvae.

Reference Books	• A. Gardner, R. T. Howell and T. Davies: Human Genetics, Viva Books Private Limited, New Delhi. • D. Peter Snustad and Michael J. Simmons: Principles of Genetics, Wiley: John Wiley & Sons, Inc ISBN- 978-0-471-72597-8 • A. F. Griffiths, S. R. Wessler, R. C. Lewontin and S. B. Caroll (2008) Introduction to Genetic Analysis, W.H.Freeman and Company, New York.
Teaching Methodology	Laboratory work, Journal preparation
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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-III: Course: BT-MJ-303: Applications of Statistical Methods in Biology-I

Course Code	BT-MJ-303
Course Title	**Applications of Statistical Methods in Biology-I**
Course Level	200-299
Credit	4
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	The course will give students a brief introduction regarding application of statistical methods in biology, which is an integral part of any research study or industrial data management related to science. The student will be able to graphically represent the given data and do basic calculation for scrutinising it.
Course Objective	To inculcate statistical practices among biology students.
Course Outcomes	CO1: The students will learn about basic idea of data representation. CO2: The unit will give students the overview interpreting the given data on the basis of central tendency. CO3: The students will learn how to interpret the nature of data and Vital Statistics. CO4: The unit will give students the overview regarding probability and its application under different situations.

Mapping between COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

Pre-requisite	Biology & Fundamental Mathematics	
Course Content	**UNIT-1: Introduction of Biostatistics** • Definitions, Limitations, and Application of Statistics in different branches of Sciences. • Graphical Representation of Data: Advantages, Disadvantages and General rules/Principles, Types of Graph [Line Graph (simple), Bar graph (Simple, Grouped and sub-divided), Pie chart (Simple, Histogram (Equal class interval) and Frequency polygon)] and examples of each type.	Teaching Hours: 15

	UNIT-2: Measures of Central Tendency and Dispersion • Definition, Important Properties, Measures of Arithmetic Mean, Harmonic Mean, Geometric Mean, Weighted Mean, Combined Mean, Corrected Mean Median, and Mode (Direct method for ungrouped and grouped data), Partition Value (Quartile, Decile and Percentile), • Mean Deviation from Mean, Variance, Standard deviation and Coefficient of Variance (Problems for each type)	Teaching Hours: 15
	UNIT-3: Skewness, Kurtosis and Vital Statistics • Skewness (Positive and Negative), Measures of Skewness (Karl Pearson, Bowley's and Kelly's Coefficient of Skewness and Moment based measure) Kurtosis (Mesokrutic, Leptokrurtic, Platykurtic), Measure of kurtosis based on Moments. • Definition and Application of Vital Statistics, Measure of Fertility, Reproduction Rate and Mortality.	Teaching Hours: 15
	UNIT-4: Probability • Definition and Application of Mathematical, Statistical and Axiomatic Probability. • Sample space, Events, Mutually Exclusive, Equally likely and Compound Events, Dependent and Independent events. • Addition, Multiplication theorem of Probability and Conditional Probability (without proof and with simple examples).	Teaching Hours: 15
Reference Books	• S. P. GUPTA (2013) Statistical Methods (Ed. 42nd) Sultan Chand & Sons, Educational Publishers, New Delhi, India. • Tulsian P. C. (2014) Business Statistics (Ed. 2nd) Jhunjhnuwala Bharat, Educational Consultant, New Delhi, India. • Sharma K. K. (2015) Business Statistics (Ed. 12th) Krishna Prakashan Media (P) Ltd., Meerut (U.P.), India. • Arora P. N. and Malhan P. K. (2008) Biostatistics (Ed. 1st) Himalaya Publishing House, India.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

Recommended Learning Resources:

- Black, J. G. Microbiology: Principles and Explorations. Hoboken, NJ: Wiley.
- Willey J. M, Sherwood L M. & Woolverton C. J., (2017), Prescott's Microbiology, 7th and 10th ed., Mc Graw – Hill science.
- Pelczar, M. J., & Chan, E. C. S. (1998). Microbiology, 5th Ed., Tata-McGraw-Hill.
- Denise Anderson, Sarah Salm, Deborah Allen, () *Nester's Microbiology- A Human Perspective*, 8th edition, Mc Graw Hill Higher Education, (ISBN: 0-07-121493-3).

MULTIDISCIPLINARY COURSE (MDC)
MB-MDC-301

Marine Microbiology

1. Course Description:

Course Code: MB-MDC-301
Course Title: Marine Microbiology
Course Type: Multidisciplinary
Course Credits: 04

2. Course Overview:

This course study includes information of marine environment and marine drug therapy. It also focuses on economic importance of marine biology and details study of microorganisms present in marine environment.

Course objectives:

- To introduce to the students the importance of different marine microorganism which sequester large amounts of carbon and produce much of world's oxygen by photo synthesis.
- The students should be aware that marine microbes are uniquely important to life. Since life most likely began in oceans. Marine microorganisms are the closet living descendants to the original forms of life.
- The students shall gain awareness of the drug likeness properties found in the marine environment.
- The economic value of products obtained from marine microorganisms are depicted as a bird's eye view in this course. As marine microorganisms serve as the foundation of all marine food webs, recycling major elements and producing useful products.

3. Course Content:

UNIT 1	Marine Microorganisms and Marine Environment
1.1	Introduction
1.2	Habitats of microorganisms
1.3	Distribution of Marine Microorganisms
1.4	Marine Microorganisms
	1.4.1 Phytoplanktons
	1.4.2 Zoo planktons
	1.4.3 Red algae
	1.4.4 Brown Algae
	1.4.5 Green Algae
	1.4.6 Multicellular Algae
1.5	Physico Chemical Properties of Marine Environment
1.6	Zonation of Ocean

UNIT 2	Economic Marine Biology
2.1	Fermented food products, surfactants, biopolymers, Enzymes, Calcium carbonate precipitation, Formation of manganese modules, Role of microorganisms in the settling of invertebrate larvae.
2.2	Spoilage of sea food
2.3	Fish diseases
	2.3.1 Bacterial pathogens associated with disease in marine animals
	2.3.2 Fungal pathogens associated with disease
2.4	Reservoir for human pathogens

UNIT 3	Marine Pollution
3.1	Causative factors and impacts
3.2	Metabolism of heavy metals
3.3	Biofouling
3.4	Corrosion
3.5	Biodegradation of pollutants

UNIT 4	Marine Drug Therapy
4.1	Antibiotics
4.2	Antiviral Compounds
4.3	Antitumor Compounds
4.4	Marine Toxins

4. Students learning Outcome

- ✓ The students shall be introduced to all marine microorganisms as well as their physico chemical properties.

- ✓ Students shall gain insight regarding the effects of marine pollution looking to the present scenario in marine environment.
- ✓ The students will be enriched with the different products obtained from marine environment and their marine drug like compounds obtained from the sea.

Recommended Learning Resources:

- Modi H. A. (1996), Elementary microbiology – Vol. II (An introduction to microbial world), Akta Prakashan.
- Erach Bharucha (2018), Textbook of Environmental Studies, Universities Press, (ISBN: 978-81- 7371-862-5)
- Shah Alkesh I. and Rajput Krishna R. (2018), Marine Science, New Popular Prakashan, Surat, (ISBN: 978-93-87554-01-6)
- N K Pillai (1990) Marine biology and Ecology, Himalaya Publishing House, Bombay.

SKILL ENHANCEMENT COURSE (SEC)

MB-SEC-301

Microbiological Media

1. Course description:

Course code: MB-SEC-301
Course title: Microbiological media
Course type: Skill enhancement course
Course credits: 02 Theory

2. Course overview:

The purpose of this paper is to enrich students with theoretical knowledge related to different types of media used in cultivation and identification of bacteria and fungi. It will give deep understanding regarding different media used in microbiological laboratories routinely.

Course Objectives:

- To go through different types of media used to cultivate bacteria and fungi in microbiology laboratories.
- To learn basics of various biochemical test used to identify bacteria.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty): Multidisciplinary Course

Teaching & Evaluation Scheme
Semester-III & IV
[Academic Year of Implementation 2024-2025]

Semester-III

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-MDC-301	Biophysics	4	02:00	50	50	100	4
	Total	**4**	**02:00**	**50**	**50**	**100**	**4**

Semester-IV

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-III

Multidisciplinary Course: BT-MDC-301: Biophysics

Course Code	BT-MDC-301
Course Title	**Biophysics**
Credits	4
Course Level	100-199
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	To make students aware about the role of Physics in Biology
Course Objectives	This course aims to provide students with a comprehensive understanding of the fundamental principles and applications of biophysics in the context of Radioactivity, optics and fluid flow. The course is designed to bridge the gap between biology and physics, enabling students to explore the intricate relationship between physical phenomena and biological processes.
Course Outcomes	CO1: students will delve into the fundamental concepts of radioactivity. They will grasp the significance of units used to measure radioactivity and evaluate the effects of ionizing and non-ionizing radiation on human health. Moreover, students will explore practical applications through understanding autoradiography and pulse-chase experiments, enhancing their comprehension of biological research methodologies. CO2: Students will study about properties of light, lenses, the structure of the eye, refractive errors, and polarization principles. CO3: Students will explore light detection methods from photographic film to CCD technology. They'll compare camera types, understand digital image parameters, and learn about advanced techniques like fluorescence and confocal microscopy. CO4: This unit delves into fluid dynamics, covering laminar flow, viscosity, turbulence and analyse fluid dynamics in biological contexts like blood flow and plant systems.
Mapping between COs with PSOs	
Pre-requisite	Biology; Physics; Chemistry

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								

Course Content	**UNIT-1: Radioactivity** Elementary particles, Radioactive decay, Cloud chamber, Units of Radioactivity, Geiger counter, Scintillation counter, Ionizing and Non-ionizing radiation, effect of radiation on human body, Autoradiography, Pulse chase experiments.	Teaching Hours: 15
	UNIT-2: Optics and Vision Wave and particle nature of light, Diffraction, Refraction, Snell's law, Types of lenses, Magnification, Errors of Refraction, Retina and photoreceptors, Resolving power of eye, Polarization (optical rotation, Birefringence and dichroism)	Teaching Hours: 15
	UNIT-3: Optics and Detection of light. Photographic film, charged couple device (CCD), Colored camera Vs Monochrome camera, Applications of monochrome camera in microscopy (Fluorescence and confocal microscope), Parameters for capturing digital image (Exposure time, Gain factor), Deconvolution, Diffraction limitation, Optical tweezers, Super Resolution Microscopy.	Teaching Hours: 15
	UNIT-4: Fluid Dynamics Laminar flow, Coefficient of Viscosity, Factors affecting Viscosity, Stoke's law, Terminal velocity, Newtonian fluid, Turbulence and Reynolds number, Hemodynamics of blood flow, plasma skimming, Example of fluid flow in plants.	Teaching Hours: 15
Reference Books	• P. K. Srivastava (2011) *Elementary Biophysics*, Narosa Publishing House, ISBN: 978-81-7319-913-4 • G. R. Chatwal (2020) *Biophysics*, Himalaya Publishing House, ISBN: 978-93-5024-583-5 • Arrondo, J. L. R., & Alonso, A (2007) Advanced *techniques in biophysics* (Vol. 10). Springer Science & Business Media. • Subrahmanyam, N., Lal, B., & Avadhanulu, M. N. (2006). A Textbook of Optics, 1st Multicolour Edition, S.	
e-learning resources	12: Fluid Dynamics and Its Biological and Medical Applications - Physics LibreTexts	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

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VEER NARMAD SOUTH GUJARAT UNIVERSITY
University Campus, Udhna-Magdalla Road, SURAT - 395 007, Gujarat, India.
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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક :ઓથો./પરિપત્ર/૧૨૧૭૯/૨૦૨૫
તા.૩૦/૦૫/૨૦૨૫

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

વિષય:– M.Sc.(5 years Integrated) Biotechnology Sem.-3 Multidisciplinary Course -Bio-Economics નાં અભ્યાસક્રમ અંગે.

મહાશય,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર M.Sc.(5 years Integrated) Biotechnology Sem.-3 Multidisciplinary Course -Bio-Economics નો નિયુક્ત પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમને બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૯/૦૪/૨૦૨૫ની સભાના ઠરાવ ક્રમાંક:૦૫ થી કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંક:૩૬ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંક: ૧૦૦ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

કુલસચિવ(ક.ન)

પ્રતિ,
૧) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૨) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

[Subject Code-2503000503041112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-III

Multidisciplinary Course: BT-MDC-302: Bio-Economics

Course Code	BT-MDC-302
Course Title	**Bio-Economics**
Credits	4
Course Level	200-299
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	This course aims to provide an academic foundation in bio-economics by examining the dynamic interactions between biological and economic systems. It emphasizes the critical role of ecosystem health and resource sustainability in shaping economic activities and societal well-being, while analyzing how economic decisions impact natural environments.
Course Objectives	This course introduces students to the interdisciplinary field of bio-economics, covering key concepts, theories, and ecological principles relevant to sustainable development and resource management. It explores economic analysis of environmental issues, such as market failures and externalities, and examines policy tools for environmental management. Students will also apply bio-economic principles to real-world sectors like agriculture, health, and natural resource management.
Course Outcomes	CO1: Students will gain a comprehensive understanding of bio-economics, including its interdisciplinary nature, CO2: Key concepts (scarcity, efficiency, trade-offs), and theories (ecological economics, environmental economics, agricultural economics), enabling them to evaluate and apply sustainable resource management strategies and decision-making processes. CO3: It will equip students with a solid foundation in understanding the relationship between economics and the environment. They will develop the knowledge and analytical skills necessary to assess and evaluate environmental issues, policies, and projects from an economic perspective. CO4: Students will have the knowledge and skills necessary to understand and address the economic challenges and opportunities associated with farming systems, healthcare systems, natural resource management,
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

Pre-requisite	Fundamental knowledge of Economics, Biology, Mathematics and Statistics, Environment Science, Agricultural Science and Social Science.

Course Content	**UNIT-1: Introduction to Bio-Economics:** Definition and scope of bio-economics; Theories in bio-economics: ecological economics, environmental economics, agricultural economics, Interdisciplinary nature of bio-economics.	Teaching Hours: 12
	UNIT-2: Key Concepts in Bio-Economic Analysis: Key concepts in bio-economics (scarcity, efficiency, trade-offs); Steps in Bio-Economic analysis (Problem identification, Parameter estimation, Bio-economic modelling and decision-making), Concept of Circular Vs Linear Economy, Case studies.	Teaching Hours: 16
	UNIT-3: Economic Analysis of Environmental Issues: Cost-benefit analysis for environmental projects; Economic instruments for environmental management: taxes, subsidies, cap-and-trade; Environmental policy and regulation (The United States and India), Market failures and externalities in relation to the environment, Environmental damage compensation (CPCB Guidelines).	Teaching Hours: 16
	UNIT-4: Bio-Economic Applications: Agricultural economics: farming systems, food supply chains, agricultural policies applicable in India; Health economics: economic analysis of healthcare network in India, health policy evaluation of India; Natural resource economics: fisheries management, forestry, biodiversity conservation.	Teaching Hours: 16
Reference Books	• "Bioeconomics: Principles and Applications" by Colin W. Clark and Gordon R. Munro. • "Nature's Economy: A History of Ecological Ideas" by Donald Worster. • "Environmental Economics: An Introduction" by Barry C. Field and Martha K. Field. • "Environmental and Natural Resource Economics" by Jonathan M. Harris and Brian Roach. • "Agricultural Economics and Agribusiness" by Gail L. Cramer and Clarence W. Jensen. • "The Economics of Health and Health Care" by Sherman Folland, Allen C. Goodman, and Miron Stano. • "Natural Resource Economics: An Introduction" by Barry C. Field and Martha K. Field.	
e-learning resources	• https://doi.org/10.4236/jssm.2024.172006	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

NEP 20, CBCS Semester system

S. Y. B. Sc. Bioscience (Microbiology)

MDC & SEC Syllabus

Semester III & IV (New)

(Effective from June 2024)

Semester III

Paper No.	Paper Title	Credit	Hrs.
BM-MDC- 3	Instrumentation & Biostatistics	**2**	**2**
BMP-MDC- 3	Instrumentation & Biostatistics Practical	**2**	**4**
BM-SEC-3	Introduction to Haematology	**1**	**1**
BMP-SEC- 3	Introduction to Haematology-Practical	**1**	**2**

Semester IV

Paper No.	Paper Title	Credit	HRS.
BM-SEC-3	Clinical Biochemistry	**1**	**1**
BMP-SEC- 3	Clinical Biochemistry-Practical	**1**	**2**

Skill Enhancement Course - SEC
S. Y. B. Sc. Semester - III
BM-SEC-3: Introduction to Haematology

Unit: I Blood **[15 Hrs.]**

- Blood constituent-Blood Plasma, Serum. Blood cells – RBC, WBC, Thrombocytes.
- Structure, functions & types of hemoglobin, Abnormal Hb.
- Transport of Oxygen & Carbon dioxide.
- Introduction to Homeostasis, Blood Coagulation Mechanism.
- Blood pressure - Systolic, diastolic. Measurement of blood pressure.

$$$$$

S. Y. B. Sc. Semester - III
Skill Enhancement Course - SEC
BMP-SEC-3: Introduction to Haematology Practical
(Time duration: 2 hours/week)

1. Determination of blood groups.
2. Blood cell count: RBC count.
3. Total WBC count.
4. Differential counts (DC).
5. Estimation of hemoglobin by Sahli's method.
6. Preparation of hemin crystals.
7. Measurement of blood pressure.
8. Determination of clotting time by capillary method.

Reference books:

- **Practical Hematology** by Davis.
- **Physiological basis of medical practice** by Best & Tailor, B. I. Waverly Publications.
- **Anatomy & Physiology for Nurses** by Smith.
- **Medical Physiology** by Sembulingam, 5th ed. Jaypee Publications.

$$$$$

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty):
Skill Enhancement Course

Teaching & Evaluation Scheme
Semester-III & IV
[Academic Year of Implementation 2024-2025]

Semester-III

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-301	Seed Technology	1	00:30	12	13	25	1
BTP-SEC-301	Seed Technology: Practical	2	03:00	13	12	25	1
	Total	**3**	**03:00**	**25**	**25**	**50**	**2**

Semester-IV

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-401	Isolation and Enumeration of Microbes	1	00:30	12	13	25	1
BTP-SEC-401	Isolation and Enumeration of Microbes: Practical	2	03:00	13	12	25	1
	Total	**3**	**03:00**	**25**	**25**	**50**	**2**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-III

Skill Enhancement Course: BT-SEC-301: Seed Technology

Course Code	BT-SEC-301 / BTP-SEC-301
Course Title	Seed Technology / Seed Technology Practical
Credits	2 (1 credit theory & 1 credit practical)
Course Level	200-299
Total engagement	1 Credit x 15 Hours + 1 Credit x 30 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	This course is for all Students will be able to know the fundamentals of seed developments. Also, to understand the biological features of seeds. The purpose of this course is to study types of seeds, structure, seed dormancy and Factors affecting seed Germination.
Course Objectives	-This course is meant to make students will be able to know the fundamentals of different seeds, Seed Germination and physiological role of hormones. -Student will get aware about seed storage.
Course Outcomes	CO1: Students will acquire the knowledge on seed structure and types, causes of seed dormancy, methods that are used for breaking dormancy, role of phytohormones and seed banks. Understanding of the key concepts and principles in plant developmental biology. CO2: 1. After performing exercise students will able to identify different parts of the seed. 2. Students to explore the impact of light conditions on seed germination and seedling development, providing valuable insights into the role of light in plant growth. 3. This experiment allows students to explore the impact of temperature and water conditions on seed germination and seedling development, providing valuable insights into the role of temperature in plant growth. 4. This experiment allows students to explore the impact of pH conditions on seed germination and seedling development, providing valuable insights into the role of pH in plant growth. 5. Students to draw conclusions, and discuss the factors affecting seed dormancy based on their experimental results. This hands-on approach provides a practical understanding of seed dormancy and the factors influencing seed germination.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								

	CO2	
Pre-requisite	Biology	
Course Content	**UNIT-1: An Introduction to Seed Development.** 1.1 Seed: Structure and types 1.2 Seed Germination: process of germination, factors affecting germination (conditions for germination) 1.3 Seed Dormancy: Introduction, causes of seed dormancy, methods of breaking seed dormancy, advantages of seed dormancy 1.4 Physiological role of phytohormones 1.5 Seed Storage: Seed Banks, seed viability, factors affecting seed viability.	Teaching Hours: 15
	UNIT-2: Practical: 6. Study Structure of gram and bean seeds. 7. Study effect of light conditions on seed germination. 8. Study effect of temperature and water on seed germination. 9. Study effect of different pH conditions on seed germination. 10. Study seed dormancy (Demonstration).	Teaching Hours: 30
Reference Books	• Pandey, S. N., & Sinha, B. K. (2009). *Plant physiology*. Vikas Publishing House. • Verma, S. K., & Verma, M. (2008). *A textbook of plant physiology, biochemistry and biotechnology*. S. Chand Publishing. • Pandey, B. P. (1999). *Modern Practical Botany-Volume II*. S. Chand Publishing.	
e-learning resources	(PDF) Overview of seed development, anatomy and morphology (researchgate.net) Seed Dormancy and Germination - PMC (nih.gov) (PDF) Role of Seed Banks in the Conservation of Plant Diversity and Ecological Restoration (researchgate.net)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

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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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી ૨૦૨૬–૨૭ સુધી અમલમાં આવનાર S.Y. B.A., B.Com., B.Sc., B.Sc.(Computer Science) નાં AEC અને SEC (Sem-3 & 4) નો અંગ્રેજી વિષયનો અભ્યાસક્રમ અંગ્રેજી વિષયની અભ્યાસ સમિતિની તા.૧૯/૦૨/૨૦૨૪ નાં ઠરાવ ક્રમાંકઃ૨ થી મંજુર કરી સંબધિત વિદ્યાશાખાને કરેલ ભલામણ વિનયન / વાણિજય / વિજ્ઞાન / કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિનયન / વાણિજય / વિજ્ઞાન / કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ સંબધિત વિદ્યાશાખા વતીં મંજુર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલ તા.૦૧/૦૩/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ૧૦૪ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય ઈ.ચા.કુલપતિશ્રી ધ્વારા મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/English//સિલેબસ/૧૦૦૬૯/૨૦૨૪
તા. ૧૪–૦૫–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીઓ.
.....આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY
NEP – 2020 GUIDED

SYLLABUS FOR ABILITY ENHANCEMENT COURSE (AEC)

ENGLISH PROFICIENCY AND LIFE SKILLS- III

FOR B.A/ B.COM. /B.SC./B.SC. COMP. SC. (REGULAR)
SEMESTER III

FOR THE ACADEMIC YEARS 2024-25 TO 2026-27

Dr. G .K.Nanda

B.A./ B.COM. /B.SC. /B.Sc. Comp.Sc.SEM 3 : TEXT : ***English and Soft Skills*** **(Vol. 2) by S P Dhanavel (OB)**

Course Code	
Course Title	ENGLISH PROFICIENCY AND LIFE SKILLS - III
Credit	2
Teaching per Week	2 hours
Minimum weeks per Semester	15 (including class work, examination, preparation, holidays etc.)
Effective From	June 2024
Purpose of Course	To prepare the young graduates for the job market today by boosting their linguistic competency and soft skills .
Course Objective	CO1: To encourage the all round development of students by focusing on Soft Skills . CO2 : To develop and nurture the Soft Skills of the students through individual and group activities. CO3 : To expose students to write attitudinal and behavioral aspects and build the same through various tasks and activities.
Course Outcomes	After completing the course the students would have : CO1: understood of what Soft Skills is . CO2: understood the significance of Soft Skills in the working environment. CO3: developed levels in their ability through soft skills.
Mapping between COs with PSOs	
Pre-requisite	Acquaintance with basic grammar and language skills

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1					
CO2					
CO3					

Course Content	**TEXTBOOK:** ***English and Soft Skills*** **(Vol. II)by S P Dhanavel (Orient Blackswan)** • Ch. 2. Empathy Skills • Ch. 6. Positivity Skills • Ch. 8. Professional Skills • Ch. 9. Leadership Skills **Note 1**. Understanding the Story ,Vocabulary and Grammar ,Thinking about Soft Skills, Soft Skills from the Story, Proverbs on the Skills ,Soft Skills at workplace, Real life experiences – these sections from the exercises are to be prepared for the Internal and University Exams. **2.** Understanding People , Places and events , Activity ,Self Assessment – these sections may be used for homework/ Assignments for the holistic development of students.
Reference Books	1. *Building Soft Skills for Employability* by Tran Le Huu Nghia (Routledge) 2. *Soft Skills* by M. S. Rao (Motivational Press) 3. *Personality Development and Soft Skills* by Sikha Kapoor (Dreamtech Press) 4. *Soft Skills for Success* by G.R.K. Murty (Viva)
Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Test marks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination.

Distribution of Marks for the University Examination as per NEP SOP

Q 1. MCQs from Understanding the Story and from Grammar and Vocabulary-**6** to be asked from each section (Student can attempt Any 10/12)	**10 Marks**
Q 2. A. Short answer type questions (2/4) (To be asked from 'Thinking about Soft Skills 'and 'Soft Skills at the Work Place')	**04 Marks**
B. Expansion of an idea/ Proverb relating to soft skills-word limit-75 words (1/2)	**04 Marks**
C. Case Study or Real Life Experience-word limit 150 words (1/2)	**07 Marks**
	Total 25 Marks

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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

યુનિવર્સિટી ડિપાર્ટમેન્ટનાં વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ તથા યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર Bharatiya Knowledge System (BKS) નો હિન્દુ સ્ટડીઝ અભ્યાસ સમિતિની તા.૨૭/૦૫/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ૧ થી VAC હેઠળ મંજૂર કરેલ " ભારતીય જ્ઞાન પરંપરા પ્રવિષ્ટિ" સેમે–૩ નાં અભ્યાસક્રમ અંગે વિચારણા કરતા એકેડેમિક કાઉન્સિલની તા.૧૫/૦૬/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૭ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૧૫/૦૬/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૭

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર Bharatiya Knowledge System (BKS) નો હિન્દુ સ્ટડીઝ અભ્યાસ સમિતિની તા.૨૭/૦૫/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ૧ થી VAC હેઠળ મંજૂર કરેલ " ભારતીય જ્ઞાન પરંપરા પ્રવિષ્ટિ" સેમે–૩ નાં અભ્યાસક્રમ મંજુર કરવામાં આવે છે. તથા સેમે.–૩ માં ફરજીયાતપણે સદર અભ્યાસક્રમનો અમલ કરવાનો રહેશે, અન્ય વિકલ્પ આપી શકાશે નહી.

(બિડાણ : ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/૧૨૭૯૯/૨૦૨૪
તા. ૧૯–૦૬–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ,
૨) યુનિવર્સિટી ડિપાર્ટમેન્ટના વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો–ઓર્ડિનેટરશ્રીઓ.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
૪) કો–ઓર્ડિનેટરશ્રી, IKS Centre - Centre for Hindu Studies, વી. ન. દ. ગુ. યુનિ. સુરત.

..... જાણ તથા ઘટતું થવા.

વીર નર્મદ દક્ષિણ ગુજરાત વિશ્વવિદ્યાલય

અભ્યાસક્રમ : 'ભારતીય જ્ઞાન પરંપરા પ્રવિષ્ટિ'

એકેડેમિક કાઉન્સિલ તા. 15-06 -2024
બાબત 9.7 બિડાણ/પરિશિષ્ટ 15

સેમેસ્ટર-૩ વર્ષ: ૨૦૨૪-૨૫

ક્રેડિટ : ૨

કુલ કલાકો : 30

યુનિટ	વિષય
૧	➢ ભારતીય વાંગ્મય અને અષ્ટાદશ વિદ્યાસ્થાન ➢ લોકજીવન અને વાચિક પરંપરાઓમાં ભારતીય જ્ઞાન પરંપરા ➢ ભારતીય જ્ઞાન પરંપરાની વૈશ્વિક આવશ્યકતા ➢ ભારતીય જ્ઞાન પરંપરા હ્રાસનાં કારણો અને પુર્નજાગરણ • વિદેશી આક્રમણોથી ઉદ્ભવેલ અસ્થિરતા • અંગ્રેજો દ્વારા બિનઔદોગિકીકરણ
૨	➢ ભારતીય જ્ઞાન પરંપરામાં સામાજિક વ્યવસ્થાઓ અને કળા • વ્યક્તિ,કુટુંબ,લોક,રાજ્ય અને રાષ્ટ્ર , • નૃત્ય, સંગીત, સ્થાપત્ય કળાઓ. ➢ પ્રાચીન ભારતમાં વિજ્ઞાન અને પ્રોદ્યોગિકી • કૃષિવિજ્ઞાન, ધાતુશાસ્ત્ર, ખગોળવિજ્ઞાન, વસ્ત્ર ઉદ્યોગ ➢ ભારતીય પરંપરામાં અર્થ વિચાર અને સંચાલન • આચાર્ય કૌટિલ્યનું અર્થશાસ્ત્ર

<u>સંદર્ભ ગ્રંથ:</u>

૧. સુરેશ સોની, ભારતમાં વિજ્ઞાનની ઉજ્જળ પરંપરા, સાહિત્ય, સાધના ટ્રસ્ટ.

૨. પ્રશાંત પોળ, ભારતીય જ્ઞાનનો ખજાનો, ભારત શોધ સંસ્થાન.

૩. ઓમપ્રકાશ પાંડે, ભારત વૈભવ રાષ્ટ્રીય પુસ્તક ન્યાસ ભારત.

૪. Soni Suresh, India's Glorious Scientific traditional , Prabhat Prakashan, 2020.

૫. Treasure Trove of Indian Knowledge: Discovering India's Rich Intellectual Heritage by Prashant Pole.

૬. રાકેશ સિંહ, ભારતીય જ્ઞાન પરંપરા, ભારતીય વિચારમંચ.

Veer Narmad South Gujarat University

Syllabus: Bharatiya Knowledge System / Bhartiya Gyan Parampara

Semester-3 Year: 2024-25

Credit: 02 **Total Hours :30**

Unit	Subject
1	➢ Bharatiya Vangmay and Aṣṭādaśa-vidyās (Bharatiya Literature and the Eighteen Sciences) ➢ Bharatiya knowledge tradition in Bharatiya folk life and its oral tradition. ➢ The global necessity, importance, and relevance of Bharatiya knowledge traditions. ➢ Reasons for the decline and revival of Bharatiya knowledge traditions: ▪ Instability due to foreign invasions. ▪ Deindustrialization by the British.
2	➢ **Social Systems and Arts in Bharatiya Knowledge Traditions** o Social structures including family, community, state, and Nation. o Arts such as dance, music, and architecture. ➢ **Ancient Bharatiya Science and Technology** o Exploration of fields such as agriculture, metallurgy, astronomy, and the textile industry. ➢ **Economic Thoughts and Administration in Bharatiya Traditions** o Insights from texts like Kautilya's Arthashastra.

<u>સંદર્ભ ગ્રંથ:</u>

૧. સુરેશ સોની, ભારતમાં વિજ્ઞાનની ઉજ્જળ પરંપરા, સાહિત્ય, સાધના ટ્રસ્ટ.

૨. પ્રશાંત પોળ, ભારતીય જ્ઞાનનો ખજાનો, ભારત શોધ સંસ્થાન.

૩. ઓમપ્રકાશ પાંડે, ભારત વૈભવ રાષ્ટ્રીય પુસ્તક ન્યાસ ભારત.

૪. Soni Suresh, India's Glorious Scientific traditional , Prabhat Prakashan, 2020.

૫. Treasure Trove of Indian Knowledge: Discovering India's Rich Intellectual Heritage by Prashant Pole.

૬. રાકેશ સિંહ, ભારતીય જ્ઞાન પરંપરા, ભારતીય વિચારમંચ.

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 :ઓથો./પરિપત્ર/૬૬૨૩/૨૦૨૫
તા.૧૭/૦૩/૨૦૨૫

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

વિષયઃ– NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગ અંગે.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO સાથે CO નાં મેપિંગને મંજૂર કરવા અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૫ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૫</u>

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી.બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરી વિજ્ઞાનવિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ અન્વયે કરેલ ભલામણ સ્વીકારી NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર–I થી IV ના અભ્યાસક્રમો માટે PSO અને CO સર્વાનુમતે મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 મુજબ બી.એસસી. બાયોટેકનોલોજી પ્રોગ્રામના સેમેસ્ટર– I થી IV ના અભ્યાસક્રમો માટે PSO અને CO બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૫ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ૩૭ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

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 Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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-III & IV

[Academic Year of Implementation 2024-2025]

Semester-IV

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-MJ-401	Fundamentals of Immunology	2	01:00	25	25	50	2
BTP-MJ-401	Fundamentals of Immunology: Practical	4	06:00	25	25	50	2
	Total	**6**	**07:00**	**50**	**50**	**100**	**4**
BT-MJ-402	Basics of Molecular Biology	2	01:00	25	25	50	2
BTP-MJ-402	Basics of Molecular Biology: Practical	4	06:00	25	25	50	2
	Total	**6**	**07:00**	**50**	**50**	**100**	**4**
BT-MJ-403	Applications of Statistical Methods in Biology-II	4	02:00	50	50	100	4
	Total	**4**	**02:00**	**50**	**50**	**100**	**4**
	Total	16	16:00	150	150	300	12

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-IV: Course: BT-MJ-401: Fundamentals of Immunology

<table>
<tr><td>Course Code</td><td colspan="2">BT-MJ-401</td></tr>
<tr><td>Course Title</td><td colspan="2">Fundamentals of Immunology</td></tr>
<tr><td>Course Level</td><td colspan="2">200-299</td></tr>
<tr><td>Credit</td><td colspan="2">2</td></tr>
<tr><td>Total engagement</td><td colspan="2">2 Credits x 15 Hours = 30 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="2">2 h</td></tr>
<tr><td>Minimum weeks per semester</td><td colspan="2">15 weeks (Including classwork, examination, preparation & holidays)</td></tr>
<tr><td>Effective from</td><td colspan="2">2024-2025</td></tr>
<tr><td>Purpose of Course</td><td colspan="2">The purpose of the course is to give knowledge to the students regarding the Fundamentals of Immunology.</td></tr>
<tr><td>Course Objective</td><td colspan="2">To provide knowledge on essential features of Non-specific and Specific Host Resistance.</td></tr>
<tr><td>Course Outcomes</td><td colspan="2">CO1: Students would gain detailed understanding about immune system and Non-specific Host Resistance.
CO2: The student will be able to get knowledge of Specific immunity.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="2">
<table>
<tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</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>Pre-requisite</td><td colspan="2">Biology, Microbiology</td></tr>
<tr><td rowspan="2">Course Content</td><td>UNIT-1: Introduction to Immune System and Non-Specific Resistance
Overview of host resistance, Cells of the immune system, Organs and tissues of the immune system and Physical barriers in non-specific resistance, Phagocytosis, Inflammation, Chemical mediators in non-specific (Innate) resistance: Antimicrobial peptides, Complement, Cytokines and Acute-Phase proteins.</td><td>Teaching Hours: 15</td></tr>
<tr><td>UNIT-2: Specific Host Resistance
Overview of specific immunity, Antigens, Types of specific immunity, Recognition of Foreignness and T cell biology, B cell biology, Immunoglobulin structure, function and classes, Antibody kinetics and action of antibodies, Autoimmunity.</td><td>Teaching Hours: 15</td></tr>
<tr><td>Reference Books</td><td colspan="2">• Willey, J.M., Sherwood, L. M., & Woolverton, C. J., (2008). Prescott, Harley & Klein's Microbiology, 7th Edition, The McGraw-Hill Companies, Inc.</td></tr>
</table>

	• Kuby Janis, (2007). *Immunology*, 6th Edition, Freeman and Company
e-learning resources	SWAYAM (https://swayam.gov.in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

Semester-IV: Course: BTP-MJ-401: Practical

Course Code	BTP-MJ-401
Course Title	**Fundamentals of Immunology: Practical**
Course Level	200-299
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	2024-2025
Purpose of Course	The purpose of the experiments is to give exposure of practical knowledge to the students in the field of Immunology.
Course Objective	To provide hands on experience to the students and learn planning, execution and how to draw inference from the practical.
Course Outcomes	CO1: Determine the blood group of a given blood sample using the slide agglutination technique. CO2: Conduct blood cross matching tests using the tube method. CO3: Accurately count cells using a Haemocytometer. CO4: Determine the differential leukocyte count of a given blood sample. CO5: Perform single radial immunodiffusion using Mancini's technique. CO6: Execute an enzyme-linked immunosorbent assay (ELISA) or Dot ELISA. CO7: Detect malaria antigens using commercially available kits. CO8: Conduct a Widal test for the diagnosis of typhoid. CO9: Diagnose syphilis using the Rapid Plasma Reagin (RPR) test. CO10: Understand the principles and steps involved in Western Blotting through demonstration.
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, Biochemistry, Microbiology
Course Content	1. To determine the blood group of given blood sample by the slide agglutination technique. 2. Blood cross matching test (Tube method). 3. Cell counting by Haemocytometer.

	4. To determine the differential leukocyte, count of the given blood sample. 5. To perform single radial immunodiffusion by using Mancini's technique. 6. To perform an enzyme-linked immunosorbent assay (ELISA)/Dot ELISA. 7. To detect malaria antigen using commercially available kits. 8. To perform Widal test for the diagnosis of typhoid. 9. Diagnosis of Syphilis by Rapid Plasma Reagin (RPR) test. 10. Western Blotting (Demonstration).
Reference Books	• Textbook Of Medical Laboratory Technology Clinical Laboratory Science And Molecular Diagnosis 2 Vol Set 3rd Ed. (Pb 2018) by Praful B. Godkar and Darshan P. Godkar. • Patel R. J. & Patel K. R. (2016) Experimental Microbiology Part I/II. Aditya Publication, Ahmedabad.
Teaching Methodology	Laboratory work, Journal preparation
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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-IV: Course: BT-MJ-402: Basics of Molecular Biology

<table>
<tr><td>Course Code</td><td colspan="3">BT-MJ-402</td></tr>
<tr><td>Course Title</td><td colspan="3">Basics of Molecular Biology</td></tr>
<tr><td>Course Level</td><td colspan="3">200-299</td></tr>
<tr><td>Credit</td><td colspan="3">2</td></tr>
<tr><td>Total engagement</td><td colspan="3">2 Credits x 15 Hours = 30 Hours</td></tr>
<tr><td>Teaching per week</td><td colspan="3">2 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">2024-2025</td></tr>
<tr><td>Purpose of Course</td><td colspan="3">The purpose of the course is to provide students with fundamental knowledge and understanding of the principles, concepts, and techniques used in molecular biology.</td></tr>
<tr><td>Course Objective</td><td colspan="3">Students will gain insight into the molecular mechanisms underlying biological processes.</td></tr>
<tr><td>Course Outcomes</td><td colspan="3">CO1: Students will demonstrate a comprehensive understanding of genome structure and replication mechanisms, facilitating insights into inheritance patterns, genetic diversity, and evolutionary dynamics. This knowledge equips them to contribute meaningfully to fields such as genetics, biotechnology and evolutionary biology.
CO2: Students will grasp the significance of mutation and recombination in driving genetic diversity and evolutionary processes, enhancing their understanding of genetic variation and adaptation.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="3"><table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</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>Pre-requisite</td><td colspan="3">Biology</td></tr>
<tr><td rowspan="2">Course Content</td><td>UNIT-1: Gene and Chromosome
-Central Dogma of life,
-Gene, Genome, Chromosome, Genome sequence and Chromosome Diversity, The Nucleosome, Higher Order Chromatin Structure, Nucleosome Assembly.
The Replication of DNA
-DNA replication: The process and chemistry of DNA synthesis, The type and mechanism of DNA Polymerase.</td><td>Teaching Hours: 15</td></tr>
<tr><td>UNIT-2: Transcription, Translation and Post Transcriptional and Translational Modifications.</td><td>Teaching Hours: 15</td></tr>
</table>

Reference Books	• Watson J. *et al.* ((2014). Molecular Biology of genes, 7th Edition, Pearson Education Inc. • Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology, 7th Edition, McGraw Hill International Edition. • Pal, J. K. and Ghaskadbi, S. S. (2009). Fundamentals of Molecular Biology, Oxford University Press. • U. Satyanarayan: Text book of Medical Biochemistry
e-learning resources	SWAYAM (https://swayam.gov.in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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.

Semester-IV: Course: BTP-MJ-402: Practical

Course Code	BTP-MJ-402
Course Title	**Basics of Molecular Biology: Practical**
Course Level	200-299
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	2024-2025
Purpose of Course	By engaging in practical experiments, students deepen their understanding of molecular biology concepts, enhance problem-solving abilities, and prepare for careers in research, biotechnology, medicine, and other related fields.
Course Objective	The objectives of molecular biology practical encompass providing hands-on experience in foundational laboratory techniques, reinforcing theoretical concepts through practical application, and fostering critical thinking skills.
Course Outcomes	CO1-8: Molecular biology practical aim to cultivate adeptness in laboratory methodologies, enabling students to apply theoretical insights to experimental contexts effectively, fostering their readiness for professions in research, biotechnology, and medicine.
Mapping between COs with PSOs	
Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1-8								

Course Content	1. Isolation of bacterial genomic DNA. 2. Isolation of plant DNA. 3. Determination of the concentration and purity of extracted DNA using UV spectrophotometer. 4. Estimation of DNA by DPA method. 5. Determination of DNA melting temperature and GC content percentage. 6. Extraction of RNA from baker's yeast. 7. Estimation of RNA by Orcinol method. 8. Feulgen staining of nuclear DNA in eukaryotic cells.
Reference Books	• Patel R. J. & Patel K. R. (2016) Experimental microbiology Part I/II, Aditya Publication, Ahmedabad. • Sharga, Boris & Chromiak, Ulyana & Pylypiv, Diana & Feketa, Volodymir. (2022). Molecular Biology Practicals. https://www.researchgate.net/publication/359120894_Molecular_Biology_Practicals • https://www.practical-manual-on-molecular-biology-and-genetic-engineeringrecombinant-dna-technology/109053921 • https://faculty.ksu.edu.sa/sites/default/files/bch361_handnote_1.pdf
Teaching Methodology	Laboratory work, Journal preparation
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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-IV: Course: BT-MJ-403: Applications of Statistical Methods in Biology-II

Course Code	BT-MJ-403
Course Title	**Applications of Statistical Methods in Biology-II**
Course Level	200-299
Credit	4
Total engagement	4 Credits x 15 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	The statistical analysis is an integral part of any research study or industrial data management related to science. The course will give students an analytical vision for application of statistical methods in biology. The student will be able to estimate the probabilities and correlation in the given biological data, can evaluate the data using regression analysis and can do comparative analysis of the data using index number.
Course Objective	To inculcate statistical practices among biology students.
Course Outcomes	CO1: The students will learn about basic probability distribution and its properties. CO2: The unit will give students the overview regarding the idea of evaluation correlation between the given data. CO3: The students will learn about regression analysis of the given data. CO4: The students will be able to calculate and relate the Price and Quantity index number of the given data.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

Pre-requisite	Biology, Fundamental Mathematics & Biostatistics	
Course Content	**UNIT 1: Probability Distributions:** Binomial distribution, Poisson distribution, and Normal distribution, their properties (without proof), and examples based on them.	Teaching Hours: 15
	UNIT 2: Correlation Analysis: Definition of Correlation and properties of Correlation Coefficient (without proof), Measures of Correlation for	Teaching Hours: 15

	ungrouped data: Scatter diagram method, Karl Pearson's correlation coefficient (Actual Mean method and Direct Method), Spearman's Rank correlation method (Tied and Untied ranks) [Examples for each method].	
	UNIT 3: Regression Analysis: Definition and Usage of Regression, Regression lines (X on Y and Y on X), Properties of Regression Coefficient (with simple examples), Examples for obtaining two regression line (Least square method for fitting of straight line)	Teaching Hours: 15
	UNIT 4: Index Numbers: Definition, characteristics, usage and limitations of index number, Constructing Index number (Price Index and Quantity Index): Simple aggregated and Weighted Aggregate Index number (Paasche method, Laspeyr's method, Drobish and Bowley's method, Marshell-Edgeworth method, Fisher's index number method), Test of adequacy: Time reversal test and Factor reversal test, examples based on above methods.	Teaching Hours: 15
Reference Books	• Sharma K. K. (2015) Business Statistics (Ed. 12th) Krishna Prakashan Media (P) Ltd., Meerut (U.P.), India. • Tulsian P. C. (2014) Business Statistics (Ed. 2nd) Jhunjhnuwala Bharat, Educational Consultant, New Delhi, India. • S. P. GUPTA (2013) Statistical Methods (Ed. 42nd) Sultan Chand & Sons, Educational Publishers, New Delhi, India. • Arora P. N. and Malhan P.K. (2008) Biostatistics (Ed. 1st) Himalaya Publishing House, India.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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

Undergraduate Program (Science Faculty): Minor Elective

Teaching & Evaluation Scheme

Semester-III & IV

[Academic Year of Implementation 2024-2025]

Semester-III

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
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Semester-IV

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-ME-401	Introduction to Food and Dairy Technology	2	01:00	25	25	50	2
BTP-ME-401	Introduction to Food and Dairy Technology: Practical	4	06:00	25	25	50	2
	Total	**6**	**07:00**	**50**	**50**	**100**	**4**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-IV

Minor Elective: BT-ME-401: Introduction to Food and Dairy Technology

Course Code	BT-ME-401
Course Title	**Introduction to Food and Dairy Technology**
Credits	2
Course Level	200-299
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	The purpose of the Introduction to Food and Dairy Technology course is to provide foundational knowledge in the processing and preservation of food and dairy products. It equips students with the technical skills required to ensure food safety, enhance nutritional value, and innovate new food products. Furthermore, this course addresses challenges in food production and sustainability, preparing students for careers in the food and dairy industry and research.
Course Objectives	Learning about Food and Dairy Technology is essential as it combines biotechnological principles with food production and safety. This knowledge enables students to understand the roles of microbes and enzymes in food processing and preservation, fostering innovation in the development of healthier and more sustainable food products.
Course Outcomes	CO1: Upon completing the Food Technology course, students will be able to Compare traditional and modern food technologies, understanding the basic concepts of food processing, including pasteurization, UHT, blanching, flocculation, and clearing as well as Apply various food preservation methods to enhance food safety and shelf life. CO2: Upon completing the Food Technology course, students will be able to analyze milk composition, test and grade milk, and identify contamination sources. They will understand the production and health benefits of fermented dairy products, and evaluate probiotics and prebiotics, including popular probiotic products.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	Biology, Chemistry, Basic Microbiology	
Course Content	**UNIT-1: Food Technology** Comparison between Traditional and Modern Food technology, Basic concept of Food Processing, Pasteurization & UHT Process, Blanching Process,	Teaching Hours:15

	Flocculation and Clearing, Food Spoilage and Food Preservation.	
	UNIT-2: Dairy Technology Composition and Components of Milk (Chemical composition and Physical properties), Methods of testing and grading of Milk, Contamination & Adulteration of Milk, Fermented Dairy Products: Yogurt, Cheese, Fermented Milk Beverages, Health Benefits of Probiotics and Prebiotics, Popular Probiotic products.	Teaching Hours: 15
Reference Books	• Frazier, W. C., & Westhoff, D. C. (1988) Food Microbiology. McGraw-Hill. • Wiley, J. & Sherwood, L. (2011) Prescott's Microbiology, 8th Ed., McGraw-Hill. • Modi, H. A. (2009) Dairy Microbiology, Aavishkar Publishers, Jaipur.	
e-learning resources	SWAYAM (https://swayam.gov.in/)	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

Minor Elective: BTP-ME-401 Practical

Course Code	BTP-ME-401
Course Title	**Introduction to Food and Dairy Technology: Practical**
Credits	2
Course Level	200-299
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation, holidays etc.)
Effective from	2024-2025
Purpose of Course	The purpose of course is to provide hands-on experience and apply theoretical knowledge to real-world scenarios. These practical help students develop essential skills, understand processing techniques, and ensure quality control in food and dairy products, preparing them for industry challenges.
Course Objective	Course aim to offer experiential learning, solidify theoretical concepts, and cultivate proficiency in processing and quality assurance, equipping students for professional roles in the industry.
Course Outcomes	CO: Students will engage in experiential learning, applying theoretical concepts to practical contexts, fostering adeptness in food processing techniques and quality assurance protocols, thereby enhancing their

<table>
<tr><td></td><td>preparedness for professional roles within the industry.</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>Biology, Chemistry, Basic Microbiology</td></tr>
<tr><td>Course Content</td><td>• To learn the method of preparation of Dahi/Yoghurt using different types of milk and Organoleptic evaluation of prepared product.
• Preparation of Rennet Casein.
• Sensory Evaluation of Milk.
• Chemical Tests for Milk Quality: COB, Alcohol Test
• Quality Analysis of milk by MBRT.
• Determination of chemical constituents of Food
• Microbial Analysis of Packed Food: Ice cream or Cold Drink
• Microbial Analysis of Fruit or Vegetable sample
• Production of any Probiotic drink/Product and microbial analysis of LAB.
• Visit to Dairy/Food Industry.</td></tr>
<tr><td>Reference Books</td><td>• Frazier, W. C., & Westhoff, D. C. (1988). Food Microbiology. McGraw-Hill.
• Modi, H. A. (2009). Dairy Microbiology, Aavishkar Publishers, Jaipur.</td></tr>
<tr><td>e-learning resources</td><td>• https://cbseacademic.nic.in/web_material/Curriculum/Vocational/2015/Fluid_milk_processing_XII/Dairy-products-practical%20manual%20XII.pdf
• https://prsvkm.kau.in/sites/default/files/documents/a_food_technology_laboratory_manual_0.pdf
• SWAYAM (https://swayam.gov.in/)</td></tr>
<tr><td>Teaching Methodology</td><td>Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td>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

Undergraduate Program (Science Faculty):
Skill Enhancement Course

Teaching & Evaluation Scheme
Semester-III & IV
[Academic Year of Implementation 2024-2025]

Semester-III

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-301	Seed Technology	1	00:30	12	13	25	1
BTP-SEC-301	Seed Technology: Practical	2	03:00	13	12	25	1
	Total	**3**	**03:00**	**25**	**25**	**50**	**2**

Semester-IV

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-401	Isolation and Enumeration of Microbes	1	00:30	12	13	25	1
BTP-SEC-401	Isolation and Enumeration of Microbes: Practical	2	03:00	13	12	25	1
	Total	**3**	**03:00**	**25**	**25**	**50**	**2**

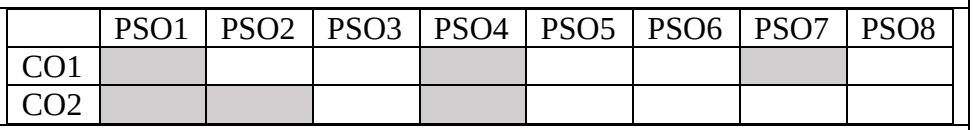
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-IV

Skill Enhancement Course: BT-SEC-401: Isolation and Enumeration of Microbes

Course Code	BT-SEC-401 / BTP-SEC-401
Course Title	Isolation and Enumeration of Microbes / Isolation and Enumeration of Microbes: Practical
Credits	2 (1 credit theory & 1 credit practical)
Course Level	200-299
Total engagement	1 Credit x 15 Hours + 1 Credit x 30 Hours = 45 Hours
Teaching per week	3 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2024-2025
Purpose of Course	This course will give students the introduction of media, different media types, methods to cultivate anaerobic microbes and enumeration techniques. Also, will help to develop practical skills to handle, prepare and isolate and estimate microbes using various techniques.
Course Objectives	- To understand various types of culture media - To create awareness regarding how each technique differs from other - Techniques used for cultivation of anaerobic microbes - Techniques for enumeration of microbial population size.
Course Outcomes	CO1: Students will gain knowledge about media, different types, methods used of anaerobic cultivation, techniques to enumerate microbes. CO2: Students will gain skills regarding media preparation, bacterial isolation & detection, and enumeration of population size.
Mapping between COs with PSOs	
Pre-requisite	Biology, Chemistry, Microbiology
Course Content	**UNIT-1: Isolation and Enumeration Techniques.** Culture media and its types (complex media, defined media, special/functional media), Anaerobic cultivation methods, Methods to detect and measure microbial population (Direct cell count, Viable cell count, Measuring biomass). — Teaching Hours: 15
	UNIT-2: Practical. 8. Isolation of microbes using selective and differential media. 9. Isolation and cultivation of anaerobic bacteria using thioglycolate medium. — Teaching Hours: 30

	10. Enumeration of microbial population using standard plate count method. 11. Enumeration of yeast using haemocytometer. 12. MPN for coliforms.	
Reference Books	• Anderson, D., Salm, S., Allen, D., & Nester, E. (2016). *Nester's Microbiology- A Human Perspective* (8th ed.). McGraw Hill Education. • Aneja, K. (2014). *Laboratory Manual of Microbiology and Biotechnology* (1st ed.). MedTech. • Joanne Willey, L. S. (2017). *Prescott's Microbiology* (10 ed.). McGraw Hill. • Patel, R., & Patel, K. (2022). *Lecture notes on Introduction to Microbiology*. Aditya Publication. • Patel, R., & Patel,K P. (2016) *Experimental Microbiology* (9 ed., Vol. I). Aditya Publication.	
e-learning resources	https://www.youtube.com/dbtvnsgu	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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.	

MB-SEC-401

Algal growth and its application

1. Course Description:

Course Code: MB-SEC-401
Course Title: Algal growth and its application
Course Type: Skill Based
Course Credits: 01+01

2. Course Overview:

This paper offers an in-depth exploration of algal biology, cultivation, and utilization in various fields. This course delves into the diverse range of algae species, their growth requirements, and cultivation techniques, including photo bioreactors and open ponds. Students will investigate the physiological and environmental factors influencing algal growth and productivity.

Course Objectives:

- To learn collection and identification of algal culture
- To study of basic and applied science behind the production of mass culture
- To teach students about commercial applications and future potential of algae

3. Course Content:

Unit 1	**Introduction to algae**
1.1	Characteristics of Algae
1.2	Algal classification and distribution
1.3	Media for cultivation of algae
1.4	Techniques for cultivation of algae

Unit 2	**Application of algae**
2.1	Algae as food and fodder
2.2	Single cell protein (Spirulina): Its application as food supplement
2.3	Cyanobacteria as biofertilizers
2.4	Economic importance of algae: Agar-Agar, Alginate, Carrageenin and biofuels

MB-SECP-401

Practicals

1. Collection of algae from local water bodies and their microscopic examination
2. Microscopic study of different algal species using permanent slides or preserved specimens
3. Isolation and identification of economically important algae (Spirulina)
4. Estimation of protein form Spirulina
5. Isolation of cyanobacteria (blue green algae) from paddy fields

4. Student Learning Outcomes:

On the successful completion of the course, student will be able

- To isolate and identify different types of algae
- Acquire the knowledge of algal growth requirement and cultivation.
- Learn laboratory skill, lab organization & nutritional importance of different algae.
- Understand the economic importance of algae.

Recommended Learning Resources:

- Srivastava, H.N. 1999. Algae. Pradeep publications, Meerut.
- Sharma, O.P. 2004. A textbook of Algae. Tata McGraw- Hill publishing Company Limited, New Delhi.
- Bilgrami, K.S. and Saha, L.C. 2012. A textbook of Algae. CBS Publishers & Distributors Pvt. Ltd., New Delhi.
- Pandey, S.N., Misra, S.P., and Trivedi, P.S. 1997. A textbook of Botany, Vol. II, Vikas Publishing House Pvt. Ltd.
- Dubey, R. C. (2009). Multicolour Textbook of Biotechnology. S. *Chand and Co., New Delhi*, 71-80.
- Pelczar, M. J., Chan, E. C. S., & Krieg, N. R. (2001). Textbook of microbiology. *MC Graw-Hill publications, 5th edn, New York, 1193*, 504-508.
- Aneja, K. R. (2018). Experiments in microbiology, plant pathology, tissue culture and microbial biotechnology.

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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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

–: પરિપત્ર :–

વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪–૨૫ થી ૨૦૨૬–૨૭ સુધી અમલમાં આવનાર S.Y. B.A., B.Com., B.Sc., B.Sc.(Computer Science) નાં AEC અને SEC (Sem-3 & 4) નો અંગ્રેજી વિષયનો અભ્યાસક્રમ અંગ્રેજી વિષયની અભ્યાસ સમિતિની તા.૧૯/૦૨/૨૦૨૪ નાં ઠરાવ ક્રમાંકઃ૨ થી મંજુર કરી સંબધિત વિદ્યાશાખાને કરેલ ભલામણ વિનયન / વાણિજય / વિજ્ઞાન / કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિનયન / વાણિજય / વિજ્ઞાન / કોમ્પ્યુટર સાયન્સ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ સંબધિત વિદ્યાશાખા વતીં મંજુર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલ તા.૦૧/૦૩/૨૦૨૪ની સભાનાં ઠરાવ ક્રમાંકઃ૧૦૪ અન્વયે માન.કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત માનનીય ઈ.ચા.કુલપતિશ્રી ધ્વારા મંજૂર કરેલ છે. જેની આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

ક્રમાંક : એસ./પરિપત્ર/English//સિલેબસ/૧૦૦૬૯/૨૦૨૪
તા. ૧૪–૦૫–૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા હેઠળની સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ તથા વિભાગીય વડાશ્રીઓ.
.....આપશ્રીની કોલેજ/વિભાગના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) અધ્યક્ષશ્રી, વિનયન, વાણિજય, સાયન્સ એન્ડ કોમ્પ્યુટર સાયન્સ વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

NEP – 2020 GUIDED

SYLLABUS FOR ABILITY ENHANCEMENT COURSE (AEC)

ENGLISH PROFICIENCY AND LIFE SKILLS- IV

FOR B.A/ B.COM. /B.SC./B.SC.COMP.SC. (REGULAR)

SEMESTER IV

FOR THE ACADEMIC YEARS 2024-25 TO 2026-27

B.A./ B.COM. /B.SC. /B.Sc. Comp. Sc. SEM 4 : TEXT : ***English and Soft Skills*** **(Vol. 2) by S P Dhanavel (OB)**

Course Code	
Course Title	ENGLISH PROFICIENCY AND LIFE SKILLS- IV
Credit	2
Teaching per Week	2 hours
Minimum weeks per Semester	15 (including class work, examination, preparation, holidays etc.)
Effective From	June 2024
Purpose of Course	To prepare the young graduates for the job market today by boosting their linguistic competency and soft skills .
Course Objective	CO1: To encourage the all round development of students by focusing on Soft Skills . CO2 : To develop and nurture the Soft Skills of the students through individual and group activities. CO3 : To expose students to write attitudinal and behavioral aspects and build the same through various tasks and activities.
Course Outcomes	After completing the course the students would have : CO1: understood of what Soft Skills is . CO2: understood the significance of Soft Skills in the working environment. CO3: developed levels in their ability through soft skills.
Mapping between COs with PSOs	
Pre-requisite	Acquaintance with basic grammar and language skills

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1					
CO2					
CO3					

Course Content	**TEXTBOOK:** ***English and Soft Skills*** **by S P Dhanavel (Orient Blackswan)** • Ch. 1. Self Esteem Skills • Ch. 3. Customer Relations Skills • Ch. 5. Cross -cultural Communication Skills • Ch. 10. Holistic and Visionary Skills **Note 1**. Understanding the Story ,Vocabulary and Grammar ,Thinking about Soft Skills, Soft Skills from the Story, Proverbs on the Skills ,Soft Skills at workplace, Real life experiences – these sections from the exercises are to be prepared for the Internal and University Exams. **2.** Understanding People , Places and events , Activity ,Self Assessment – these sections may be used for homework/ Assignments for the holistic development of students.
Reference Books	5. *Building Soft Skills for Employability* by Tran Le Huu Nghia (Routledge) 6. *Soft Skills* by M. S. Rao (Motivational Press) 7. *Personality Development and Soft Skills* by Sikha Kapoor (Dreamtech Press) 8. *Soft Skills for Success* by G.R.K. Murty (Viva)
Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Test marks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination

Distribution of Marks for the University Examination as per NEP SOP

Q 1. MCQs from Understanding the Story and from Grammar and Vocabulary-**6** to be asked from each section (Student can attempt Any 10/12) **10 Marks**

Q 2. A. Short answer type questions (2/4) **04 Marks**
(To be asked from 'Thinking about Soft Skills 'and 'Soft Skills at the Work Place')

B. Expansion of an idea/ Proverb relating to soft skills-word limit-75 words (1/2) **04 Marks**

C. Case Study or Real Life Experience-word limit 150 words (1/2) **07 Marks**

Total 25 Marks

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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-: પરિપત્ર :-

યુનિવર્સિટી ડિપાર્ટમેન્ટનાં વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો-ઓર્ડિનેટરશ્રીઓ તથા યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી સ્નાતક કક્ષાના તમામ અભ્યાસક્રમો (જે વિદ્યાશાખામાં એપેક્ષ બોડીના નિયમો લાગુ પડતા હોય તે સિવાય) માટે અમલમાં આવનાર હિન્દુ સ્ટડીઝની એડહોક અભ્યાસ સમિતિનાં ચેરમેનશ્રીએ અભ્યાસ સમિતિ વતી Bharatiya Knowledge System - ભારતીય મૂલ્ય પરંપરા-૨ નો VAC હેઠળ મંજૂર કરેલ Sem-4 નાં અભ્યાસક્રમને એકેડેમિક કાઉન્સિલની તા.૦૧/૦૩/૨૦૨૪ ની સભાનાં ઠરાવ ક્રમાંકઃ ૧૦૪ અન્વયે માન. કુલપતિશ્રીને આપેલ સત્તા અંતર્ગત એકેડેમિક કાઉન્સિલ વતી માનનીય કુલપતિશ્રી ધ્વારા મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણ : ઉપર મુજબ)

ક્રમાંક : ઓથો./પરિપત્ર/૨૫૩૯૭/૨૦૨૪
તા.૦૨-૧૨-૨૦૨૪

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન તમામ કોલેજોનાં આચાર્યશ્રીઓ,
૨) યુનિવર્સિટી ડિપાર્ટમેન્ટના વડાશ્રીઓ અને યુનિવર્સિટી કેમ્પસમાં ચાલતા સ્વનિર્ભર અભ્યાસક્રમનાં કો-ઓર્ડિનેટરશ્રીઓ.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દક્ષિણ ગુજરાત યુનિવર્સિટી, સુરત.
૪) કો-ઓર્ડિનેટરશ્રી, IKS Centre - Centre for Hindu Studies, વી. ન. દ. ગુ. યુનિ. સુરત.

..... જાણ તથા ઘટતું થવા.

Subject Code [2403000504070001]

Veer Narmad South Gujarat University Surat

Year: 2024-25

VAC:- Sem-4 (ભારતીય મુલ્ય પરંપરા-૨) Credit-2

યુનિટ	વિષય
૧.	➢ ભારતીય પરંપરામાં મૂલ્યશિક્ષણની વાર્તાઓ. ❖ સત્ય અને જ્ઞાન- નચિકેતાની વાર્તા (કઠોપનિષદ) ❖ ધર્મ અને એકાત્મતા-યુધિષ્ઠિર અને યક્ષની વાર્તા (મહાભારત) ❖ નિસ્વાર્થવૃતિ અને ત્યાગ- રાજા શિબીની વાર્તા (વિષ્ણુ પુરાણ) ❖ અનાસક્તિ અને બુદ્ધિ- રાજા જનક અને ઋષિ યાજ્ઞવલ્કયની વાર્તા (બૃહદારણ્યકોપનિષદ)
૨.	(A) ➢ ષડ્ સંપદ:- શમ, દમ, ઉપરતિ, તિતિક્ષા, વૈરાગ્ય, વિવેક. ➢ ષડરિપુ:- કામ, ક્રોધ, લોભ, મોહ, મદ, મત્સર. ➢ ધર્મના પ્રમુખ દસ લક્ષણ અને મુખ્ય આઠ પ્રકાર. ❖ ધર્મના લક્ષણ:- ધૃતિ, ક્ષમા, દમ, અસ્તેય, શૌચ, ઈન્દ્રિયનિગ્રહ, ધી, વિદ્યા, સત્યમ, અક્રોધ ❖ ધર્મના પ્રકાર:- સ્વધર્મ, પરીવારિક ધર્મ, સમાજધર્મ, રાષ્ટ્રધર્મ, સમષ્ટિધર્મ, યુગધર્મ, આપદધર્મ, ઋતમ્ (B) ❖ नाभिषेको न संस्कारः सिंहस्य क्रियते वने । विक्रमार्जितराज्यस्य स्वयमेव मृगेंद्रता॥ ❖ विद्या विवादाय धनं मदाय शक्तिः परेषां परिपीडनाय। खलस्य साधोः विपरीतमेतद् ज्ञानाय दानाय च रक्षणाय

	❖ अतितृष्णा न कर्तव्या तृष्णां नैव परित्यजेत्। शनैः शनैश्च भोक्व्यं स्वयं वित्तमुपार्जितम्॥ ❖ साहित्य-संगीत कलाविहीनः साक्षात्पशुः पुच्छविषाणहीनः। तृणं न खादन्नपि जीवमानः तद्भागधेयं परमं पशूनाम् ❖ सुखस्य मूलं धर्मः। धर्मस्य मूलमर्थः। अर्थस्य मूलं राज्यम्। राज्यस्य मूलम् इन्द्रियजयः। इन्द्रियजयस्य मूलं विनयः। विनयस्य मूलं वृद्धोपसेवः। वृद्धोपसेवया विज्ञानम्। विज्ञानेन आत्मानं संपादयेत्। संपादितात्मा जितात्मा भवति। जितात्मा सर्वार्थैः संयुज्येत।

Veer Narmad South Gujarat University Surat

Year: 2024-25

VAC:- Sem-4 (ભારતીય મુલ્ય પરંપરા-૨)

Credit-2

Unit	Subject
1	**Stories based on value education in Indian Tradition:** ❖ Truth and realisation :The story of Nachiketa(Kathopanishad) ❖ Dharma and Oneness :The Story of Yudhishthir and Yaksha(Mahabharat) ❖ Selflessness and Sacrifice :The story of King Shibi (Vishnu Puran) ❖ Detachment and Wisdom:The story of King Janaka and sage Yajnavalkya (Brihadaranyakopanishad)
2	**(A)** **Six Treasures :** 1. Shama(Inner tranquility of mind), 2. Dama(Alignment between mind and senses), 3. Uparati(Interest to do work) 4. Titiksha(Forbearance) 5. Vairagya(Detachment) 6. Viveka(Conscience) **Six Enemies:** 1. Kama (Desire/lust) 2. Krodha (Anger) 3. Lobha (Greed) 4. Moha (Attachment) 5. Mada (Ego) 6. Matsarya(Jealousy) **Chief characteristic features of Dharma and eight major types:** **Characteristics of Dharma :** 1. Dhruti (Patience) 2. Kshama (Forgiveness) 3. Dama (Self-Control) 4. Asteya (Honesty) 5. Shaucha (Sanctity)

6. Indriyanigraha (Control of senses)
7. Dhi (Reason)
8. Vidya (Knowledge or learning)
9. Satyam (Truth)
10. Akrodh (Void of anger)

Types of Dharma:

1. Swadharma (Duty to self)
2. Parivarik Dharma (Duty for family)
3. Samaj Dharma (Duty for society)
4. Rashtra Dharma (Duty for the State)
5. Samshti Dharma (Duty for Community)
6. Yuga Dharma (Duty for Contemporary time)
7. Apad Dharma (Duty at the time of adversity)
8. Rutam (Duty to Natural Order)

(B)

- नाभिषेको न संस्कारः सिंहस्य क्रियते वने ।
  विक्रमार्जितराज्यस्य स्वयमेव मृगेंद्रता॥
- विद्या विवादाय धनं मदाय शक्तिः परेषां परिपीडनाय।
  खलस्य साधोः विपरीतमेतद् ज्ञानाय दानाय च रक्षणाय
- अतितृष्णा न कर्तव्या तृष्णां नैव परित्यजेत्।
  शनैः शनैश्च भोक्व्यं स्वयं वित्तमुपार्जितम्॥
- साहित्य-संगीत कलाविहीनः साक्षात्पशुः पुच्छविषाणहीनः।
  तृणं न खादन्नपि जीवमानः तद्भागधेयं परमं पशूनाम्
- सुखस्य मूलं धर्मः। धर्मस्य मूलमर्थः।
  अर्थस्य मूलं राज्यम्। राज्यस्य मूलम् इन्द्रियजयः।
  इन्द्रियजयस्य मूलं विनयः। विनयस्य मूलं वृद्धोपसेवः।
  वृद्धोपसेवया विज्ञानम्। विज्ञानेन आत्मानं संपादयेत्।
  संपादितात्मा जितात्मा भवति। जितात्मा सर्वार्थैः संयुज्येत।

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Paper Style		
Que:-1	MCQS – (5 out of 7) (From Unit-2 A (I) (II))	**Marks (10)**
Que:-2	**(From Unit-1)**	
	(a) Write a short answer **or** (a)Write a short answer	**Marks (05)**
	(b) Write a short answer **or** (b) Write a short answer	**Marks (05)**
	(From Unit-2)	
	(c) Translation and Short exploitation of two Shlokas **or** (c) Translation and Short exploitation of two Shlokas.	**Marks (05)**

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તા.૧૭/૦૩/૨૦૨૫

પ્રતિ,
વડાશ્રી,
બાયોટેકનોલોજી ડિપાર્ટમેન્ટ,
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સુરત.

વિષયઃ– NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ .

સુજ્ઞ શ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ અભ્યાસક્રમ બનાવવામાં આવેલા કોર્ષ અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૬ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૫ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૨</u>

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે કરેલ ભલામણ સ્વીકારી શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૫

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬નો અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૦૩ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

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 Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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-V & VI

[Academic Year of Implementation 2025-2026]

Semester-V

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-MJ-501	IKS in Biotechnology: Traditional and Modern Perspectives	2	1:00	25	25	50	2
BTP-MJ-501	IKS in Biotechnology: Traditional and Modern Perspectives: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-502	Genetic Engineering	2	1:00	25	25	50	2
BTP-MJ-502	Genetic Engineering: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-503	Molecular Genetics	2	1:00	25	25	50	2
BTP-MJ-503	Molecular Genetics: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**18**	**21**	**150**	**150**	**300**	**12**

[Subject Code-2503001305011001]

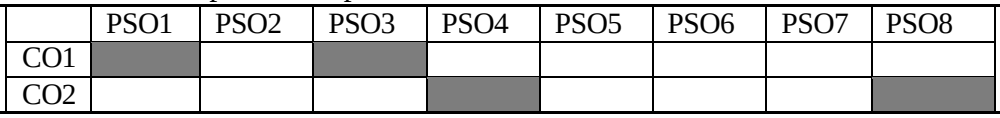
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-V

Course: BT-MJ-501: Indian Knowledge Systems in Biotechnology: Traditional and Modern Perspectives

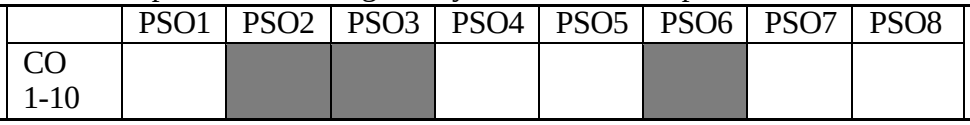
Course Code	BT-MJ-501
Course Title	**IKS in Biotechnology: Traditional and Modern Perspectives**
Credit	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	To provide an integrated overview of biotechnology by blending traditional Vedic insights on microbiology with the ground breaking contributions of modern pioneers and influential leaders in Indian biotechnology.
Course Objectives	-Introduce students to key Vedic concepts in microbiology, including the origin and prevention of germs and traditional practices like Agnihotra. -Explore the significant contributions of modern pioneers. -Highlight the impact of influential women leaders in shaping Indian biotechnology. -Encourage a holistic understanding of how ancient knowledge and modern innovations can together address contemporary challenges in biotechnology.
Course Outcomes	CO-1: Students will develop the ability to critically analyze traditional Vedic concepts in microbiology, understanding how ancient texts explain the origin, prevalence and natural control of germs. They will learn to integrate these age-old practices with modern scientific principles, fostering innovative approaches to infection prevention and health. CO-2: Students will gain a comprehensive perspective on the evolution of modern biotechnology by examining transformative contributions from pioneering scientists and leaders. They will evaluate advancements in genetic engineering, sustainable agriculture, molecular biology and biotechnology policy as well as appreciate how these innovations have reshaped healthcare and social entrepreneurship.
Mapping between COs with PSOs	
Pre-requisite	Fundamentals of Science, Biology and Microbiology
Course Content	**UNIT-1:** Vedic Microbiology: Introduction to Vedic Knowledge and Microbiology, Origin and Prevalence of Germs — Teaching Hours: 10

	(Krmis), Prevention of Infection, Elimination of Pathogens by Sun Rays and Medicinal Plants, Science of Agnihotra	
	UNIT-2: Contributions of Modern Pioneers and Influential Leaders in Indian Biotechnology: Part A: Modern Pioneers: Venkatraman Ramakrishnan- Noble Laureate, MS Swaminathan – Architect of the Green Revolution, Dr. Anand Mohan Chakrabarty – Pioneer of Genetic Engineering, Dr. Har Gobind Khorana – Decoding the Genetic Code. Part B: Influential Women Leaders in Indian Biotechnology: Kiran Mazumdar-Shaw – Visionary Entrepreneur, Preethi Reddy – Integrating Healthcare with Biotechnology, Swati A. Piramal – Transforming Public Health and Policy, Vinita Gupta – Global Leadership in Pharmaceutical Biotechnology, Soumya Swaminathan – Global Health and Scientific Leadership, Renu Swarup – Shaping National Biotech Policy, Janaki Ammal- Plant Breeding, Cytogenetics and Phytogeography	Teaching Hours: 20
Reference Books	✓ Dubey, R. C. (2021) Vedic Microbiology-A Scientific Approach, 1st Edition, Motilal Banarsidass International, Delhi. (ISBN: 978-93-9069-625-3)	
e-learning resources	✓ https://doi.org/10.1002/anie.201001436 ✓ Swaminathan, M.S. Genesis and Growth of the Yield Revolution in Wheat in India: Lessons for Shaping our Agricultural Destiny. *Agric Res* 2, 183–188 (2013). https://doi.org/10.1007/s40003-013-0069-3 ✓ file:///C:/Users/abc/Downloads/dna2z,+JCB_COMM_626.pdf ✓ https://heinonline.org/HOL/LandingPage?handle=hein.journals/rvdpo59&div=6&id=&page ✓ file:///C:/Users/abc/Downloads/jcb.2010.20.pdf ✓ https://assets.cureus.com/uploads/review_article/pdf/254520/20240609-28399-d53hnk.pdf	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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-2503001305011002]

BTP-MJ-501: Indian Knowledge Systems in Biotechnology: Traditional and Modern Perspectives Practical

Course Code	BTP-MJ-501
Course Title	**Indian Knowledge Systems in Biotechnology: Traditional and Modern Perspectives Practical**
Credit	2
Course Level	300-399
Total Engagement	2 Credit x 30 Hours = 60 Hours

Teaching per week	4 h X 1 day = 4 h
Minimum weeks per semester	15 weeks (Including Laboratory work, examination, preparation, holidays etc.)
Effective from	2025-2026
Purpose of Course	This course is designed to bridge ancient wisdom and modern innovation by exploring traditional Vedic concepts in microbiology alongside contemporary advancements in biotechnology. It integrates the study of Vedic texts and rituals with hands-on experiments, literature surveys, and comparative analyses to provide a holistic understanding of microbial processes and transformative biotech innovations.
Course Objectives	The course aims to develop the ability to interpret traditional methods of infection prevention and pathogen control by reviewing ancient texts, setting up microbial cultures, and simulating practices such as Agnihotra. It also seeks to cultivate analytical skills through experimental work, group data interpretation, and the compilation of research findings into coherent reports. Additionally, the curriculum emphasizes the evaluation of modern biotechnology advancements via comprehensive literature surveys and comparative analyses, culminating in multimedia presentations that synthesize insights from both traditional practices and modern scientific contributions.
Course Outcomes	1. Develop an understanding of traditional microbiological concepts by reviewing Vedic texts and scholarly articles. 2. Enhance literature synthesis skills through the preparation of a concise report on traditional infection prevention methods. 3. Acquire hands-on laboratory expertise by setting up microbial cultures to establish baseline growth patterns. 4. Learn experimental techniques by assessing the effects of sunlight on microbial cultures. 5. Evaluate the impact of natural remedies by applying medicinal plant extracts and recording their effects on microbial proliferation. 6. Gain practical insights into traditional fermentation by preparing Gundruk (pickle) and Chhurpi (cheese). 7. Build research competencies through a comprehensive literature survey on transformative modern biotechnological contributions. 8. Develop analytical skills by engaging in a comparative analysis of advancements in modern biotechnology across various fields. 9. Integrate and articulate research findings by compiling a detailed written report that bridges traditional Vedic concepts with modern biotechnology practices. 10. Broaden applied understanding of biotechnology through an Ayurveda Hospital visit, linking theory with real-world practice.
Mapping between COs with PSOs	
Pre-requisite	Fundamentals of Science, Biology and Microbiology

Course Content	1. Review Vedic texts and scholarly articles to explore traditional microbiological concepts, focusing on the origin and control of germs and the scientific background of Agnihotra. 2. Prepare a concise report summarizing their literature review, highlighting traditional methods of infection prevention and the rationale behind eliminating pathogens using natural elements. 3. Set up microbial cultures to establish baseline growth patterns, forming the foundation for subsequent experimental comparisons. 4. Conduct experiments by exposing microbial cultures to sunlight 5. Applying medicinal plant extracts, carefully recording the effects on microbial proliferation and pathogen elimination. 6. Preparation of Gundruk (Pickle) and Chhurpi (Cheese) a traditional fermented product of North-East India. 7. Perform a comprehensive literature survey on modern biotechnological contributions, gathering data from case studies, research articles, and reputable online resources to understand transformative innovations. 8. Engage in a comparative analysis of modern biotechnology advancements across fields such as agriculture, genetic engineering, molecular biology, healthcare, and policy-making, evaluating their overall impact. 9. Compile research findings into a detailed written report, integrating insights from both traditional Vedic concepts and modern biotechnology practices. 10. Ayurveda Hospital Visit
Reference Books	✓ Dubey, R. C. (2021) Vedic Microbiology-A Scientific Approach, 1st Edition, Motilal Banarsidass International, Delhi. (ISBN: 978-93-9069-625-3)
e-learning resources	• https://en.wikipedia.org/wiki/Chhurpi • https://en.wikipedia.org/wiki/Gundruk
Teaching Methodology	Laboratory work, Journal preparation
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

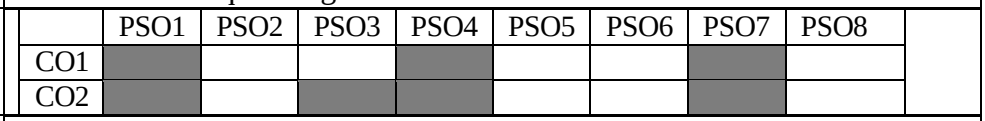
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-V

Course: BT-MJ-502: Genetic Engineering

Course Code	BT-MJ-502
Course Title	**Genetic Engineering**
Credits	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	This course will give students the introduction of gene modifications, DNA ends modifying enzymes, different types of vectors, PCR and genome sequencing methods.
Course Objectives	- To understand various types of enzymes and vectors - To teach the students basic principles of PCR, RT-PCR - learning of various gene sequencing methods
Course Outcomes	CO1: Students will gain knowledge about vectors and different enzymes CO2: Students will gain knowledge about various techniques like PCR, RT-PCR and sequencing methods.
Mapping between COs with PSOs	
Pre-requisite	Fundamentals of Biology and Biotechnology
Course Content	**UNIT-1:** Introduction to r-DNA technology, gene cloning and its importance, Restriction endo nucleases, DNA manipulative enzymes, adaptors, linkers, Vectors based on plasmid, M13, Phage lambda, yeast and other fungi, higher plants and animals, retroviral vector — Teaching Hours: 15 **UNIT-2:** Introduction of DNA to nonbacterial cells, Colony and plaque Hybridization, Practical use of Hybridization probes, PCR and its Variations, Isothermal Amplification, DNA sequencing method (Classical and NGS) — Teaching Hours: 15
Reference Books	Brown T. A. Gene Cloning and DNA analysis: An Introduction, John Wiley & Sons; 2016
e-learning resources	• https://sites.google.com/ignou.ac.in/bscbch-biochemistry/self-learning-material/bbccl-126-genetic-engineering-and-biotechnology • https://www.synthego.com/blog/genome-editing-techniques#7-gene-editing-techniques-tools-to-change-the-genome

	• https://www.cytosurge.com/applications/gene-editing-techniques
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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-2503001305022002]

BTP-MJ-502: Genetic Engineering Practical

Course Code	BTP-MJ-502
Course Title	**Genetic Engineering Practical**
Course Level	300-399
Credits	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)
Effective from	2025-2026
Purpose of Course	To provide undergraduate students with the opportunity to observe and understand the basic concepts of genetic engineering.
Course Objective	Course objectives for a Genetic engineering typically aim to provide students with a comprehensive understanding of the principles, processes, and mechanisms involved in the r-DNA technology. These objectives aim to provide students with a solid foundation in the principles of genetic engineering.
Course Outcomes	Upon completion genetic engineering Practical Course, students will: 1. Develop the skill of the plasmid isolation with alkaline lysis method. 2. Students will acquire the knowledge and skill of DNA isolation. 3. Students will acquire the practical knowledge of use of restriction endonucleases in Genetic engineering. 4. Students will develop the skill of technique gene transfer via transformation. 5. The students will be able to isolate coli phages from sewage sample 6. Students will be able to understand, differentiate, and demonstrate various PCR techniques and their applications in molecular biology, diagnostics, and research.

Mapping between Cos with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO 8
	CO 1-6								
Pre-requisite	Fundamentals of Biology and Biotechnology								

Course content	1. Isolation of plasmid DNA from *E. coli.* 2. Extraction and purification of bacterial DNA using spin column. 3. Restriction digestion of vector. 4. Transformation of bacterial cells by $CaCl_2$. 5. Enrichment and isolation of coliphages from sewage. 6. Demonstration/Visit of all types of variations of PCR
Reference Books	• Patel, R., & Patel, K P. (2016) *Experimental Microbiology* (9 ed., Vol. II) Aditya Publication.
e-learning resources	• https://sites.google.com/ignou.ac.in/bscbch-biochemistry/self-learning-material/bbccl-126-genetic-engineering-and-biotechnology
Teaching Methodology	Laboratory work, Journal preparation
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- 2503001305033001]

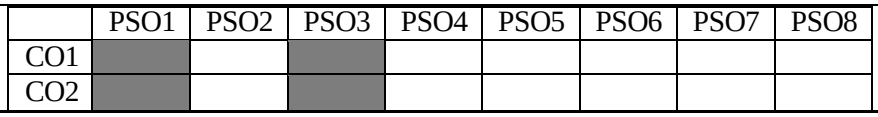
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-V

Course: BT-MJ-503: Molecular Genetics

Course Code	BT-MJ-503	
Course Title	**Molecular Genetics**	
Credits	2	
Course Level	300-399	
Total engagement	2 Credits x 15 Hours = 30 Hours	
Teaching per week	2 h	
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)	
Effective from	2025-2026	
Purpose of Course	The purpose of the course is to give knowledge to the students regarding the fundamentals of genetic variations.	
Course Objectives	The objective is to explain students about how repairing and variations occur in the genome during evolution.	
Course Outcomes	CO1: Students would be able to get details of an important mechanism of Mutation and Repair of genome. CO2: Students would get insights about various Recombination mechanisms through which variations occur in the population .	
Mapping between COs with PSOs		
Pre-requisite	Genetics, Basics of Molecular biology	
Course Content	**UNIT-1: Mutability and Repair of DNA** Types of Mutations and mutagens, Proofreading errors, DNA Damage and its Repair: Photoreactivation, Base Excision Repair, Nucleotide Excision Repair, Recombination Repair, Translesion synthesis	Teaching Hours: 15
	UNIT-2: Homologous Recombination and Transposition -Models for Homologous Recombination, Site specific Recombination, RecBCD pathway, Classes of Transposable Elements, Transposons, Mechanism of Transposition	Teaching Hours: 15
Reference Books	• Watson J. *et al.* ((2014). Molecular Biology of genes, 7th Edition, Pearson Education Inc. • Willey, J. M., Sherwood, L. M. and Woolverton, C. J. (2008). Prescott, Harley and Klein's Microbiology, 7th Edition, MCGraw Hill International Edition. • Pal, J. K. and Ghaskadbi, S. S. (2009). Fundamentals of Molecular Biology, Oxford University Press.	

Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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- 2503001305033002]

BTP-MJ-503: Molecular Genetics Practical

Course Code	BTP-MJ-503
Course Title	**Molecular Genetics Practical**
Credits	2
Course Level	300-399
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)
Effective from	2025-2026
Purpose of Course	The purpose of the course is to familiarize students with handling practical problems related to mutagenesis .
Course Objectives	The objective is to perform practical based on effect of mutagens on organisms which is responsible for genetic variations in the population.
Course Outcomes	CO1: Students will get insights how Ultraviolet radiations as mutagen affect the survival of bacteria. CO2: Several dyes also affect as mutagen and bring mutation in bacteria. Students will study the effect of these chemicals on survival rate of microorganisms. CO3: This practical reveal the method of isolation of recombinants in the culture. CO4: Isolation of yeast culture mutants would be practically performed by students. CO5: Students will gain insights about Ames test used to detect the chemical carcinogen. CO6: Students will learn how PCR technique is used for detecting mutation.
Mapping between COs with PSOs	
Pre-requisite	Genetics, Basics of Molecular biology
Course Content	1. To isolate pigment mutants of *Serretia marcescens* 2. To prepare a survival curve for the given bacterial culture using germicidal ultraviolet radiation as a mutagen. 3. To prepare a survival curve for the given bacterial using dye as a mutagen. 4. To prepare a master plate and carry out its replica plating. 5. To carry out Ames test for detection of a possible chemical carcinogen.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1 to 6								

Teaching Hours: 60

	6. PCR mediated site directed mutagenesis (Demonstration)	
Reference Books	• A. Nigam and A. Ayyagari (2009) Lab Manual in Biochemistry, Immunology and Biotechnology, Tata McGraw Hill Education Pvt. Ltd. • Patel R. J. & Patel K. R. (2016) Experimental microbiology Part MI, Aditya Publication, Ahmedabad	
Teaching Methodology	Laboratory work, Journal Preparation	
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

Undergraduate Program (Science Faculty): Minor Elective

Teaching & Evaluation Scheme

Semester-V & VI

[Academic Year of Implementation 2025-2026]

Semester-V

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-ME-501	Immunotechnology	2	1:00	25	25	50	2
BTP-ME-501	Immunotechnology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**
BT-ME-502	Advances in Bioinformatics	2	1:00	25	25	50	2
BTP-ME-502	Advances in Bioinformatics: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**
BT-ME-503	Enzymology	2	1:00	25	25	50	2
BTP-ME-503	Enzymology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**
BT-ME-504	Introduction to Nanobiotechnology	2	1:00	25	25	50	2
BTp-ME-504	Introduction to Nanobiotechnology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**

[Subject Code-25030013050410001]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

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

Semester-V

Course: BT-ME-501: Immunotechnology

Course Code	BT-ME-501
CourseTitle	**Immunotechnology**
Credits	2
Course Level	300-399
Total Engagement	2 Credits x 15Hours = 30 Hours
Teaching per week	2 hours
Minimum weeks Per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The course of Immunotechnology aims at the application of basic aspects of the Immune system for diagnostics and therapeutics.
Course Objective	To learn about various diagnostic tools, and learn about various types of autoimmune disorders and a variety of vaccines.
Course Outcomes	CO1: Gain a comprehensive understanding of monoclonal antibody production, hybridoma technology, and key diagnostic techniques such as ELISA, radioimmunoassay, and immunofluorescence, which are essential for disease detection and therapeutic applications. CO2: To develop knowledge of immune disorders, including hypersensitivity, autoimmune diseases, and immunodeficiency, while also understanding the principles of vaccine development and their role in disease prevention.

Mapping between Cos with PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	Fundamentals of Immunology	
	UNIT-1: Monoclonal Antibodies & Diagnostic Techniques Precipitation, Agglutination, Flocculation, ELISA, CLIA, Immunochromatography and Immunofluorescence, Types of monoclonal antibodies, Hybridoma technology	Teaching Hours :15
	UNIT-2: Immune Disorders & Vaccines Hypersensitivity Type I, II, III & IV, Autoimmune Diseases, Immunodeficiency, Vaccines and their types.	Teaching Hours :15
Reference Books	• Willey, J.M., Sherwood, L. M., & Woolverton, C. J. (2008). Prescott Harley & Klein's Microbiology, 7th Edition, The MCGraw-Hil Companies, Inc. • Kuby Janis, (2007). *Immunology*, 6th Edition, Freeman and Company. • Ashim K. Chakravarty (2012). Immunology and Immunotechnology Oxford University Press, ISBN-13: 978-0-19-567688-4	
e-learning resources	• SWAYAM(https://swayam.gov.in/)	

Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment Laboratory work, Journal preparation
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-2503001305041002]

BTP-ME-501: Immunotechnology Practical

CourseCode	BTP-ME-501
CourseTitle	**Immunotechnology Practical**
Credits	2
Course Level	300-399
Total Engagement	2 Credits x 30 hours= 60 hours
Teachingperweek	2 hours
Minimum weeks Per semester	15 weeks
Effectivefrom	2025-2026
Purposeof Course	The purpose of the Immunotechnology Practical Course is to provide students with hands-on experience in key immunological techniques used for diagnostic, therapeutic, and research applications.
Course Objective	The course aims to equip students with practical skills in immunology. It focuses on preparing students for research and diagnostic applications in biotechnology and clinical settings.
Course Outcomes	CO1: Teach students to quantify antigen concentrations using advanced techniques like rocket Immunoelectrophoresis. CO2: Students will gain the ability to perform the radial precipitation test. CO3: Develop students' proficiency in applying immunological techniques for diagnostics and research purposes. CO4: Students will develop the skill of technique, Dot ELISA. CO5: To learn the diagnostic method of typhoid. CO6: Students will gain insights about Southern blotting.
Mapping between Cos with PSOs	
Pre-requisite	Basics of Immunology
Course Content	1. Immunochromatography Assay. 2. Radial precipitation test. 3. Antigen Capture ELISA. 4. Dot ELISA. 5. Dreyer's tube test for diagnosis of typhoid. 6. Demonstration of Southern blotting.
Reference Books	• Textbook of Medical Laboratory Technology clinical Laboratory Science and Molecular Diagnosis 2 Vol Set 3rd Ed. (2018) by Praful Godkar and Darshan P. Godkar.

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO 1 to 6								

Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminar sand/or Assignment.
e-learning resources	• https://www.bio-rad-antibodies.com/elisa-types-direct-indirect-sandwich-competition-elisa-formats.html • https://www.nature.com/articles/nprot.2006.73
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

Undergraduate Program (Science Faculty)

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

Semester-V

Course: BT-ME-502: Advances in Bioinformatics

Course Code	BT-ME-502	
Course Title	**Advances in Bioinformatics**	
Credit	2	
Course Level	300-399	
Total Engagement	2 Credits x 15 Hours = 30 Hours	
Teaching per Week	2 h	
Minimum weeks per Semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)	
Effective From	2025-2026	
Purpose of Course	This course will give students an advance information to the various techniques of Bioinformatics. The students will become familiar with the use of a wide variety of internet applications using various tools used for phylogenetic analysis and protein prediction.	
Course Objective	The objective of this course is to provide students with theory that how to use of common computational tools and databases which are used to investigate molecular and evolution concepts	
Course Outcomes	CO1: Students will learn about construction of various phylogenetic trees by distance and cladistic methods and also learn how to perform cladogram/dendogram from various computational tools. CO2: Students will learn about various tools and techniques for prediction of protein structures and also learn about different online tools for protein structure modelling.	

Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								

Pre-requisite	Basic of Biology, Biotechnology, Biochemistry, Microbiology	
Course Content	**UNIT-1: MOLECULAR PHYLOGENY:** Phenotypic & Molecular Phylogeny, Mechanism of Molecular Phylogeny, Representation of Phylogeny, Molecular Clocks; Methods of Phylogeny (Cladistic methods – Maximum parsimony, Maximum Likelihood; Distance Method – UPGMA & NJ method; Tools for Phylogenetic analysis.	Teaching Hours :15
	UNIT-2: PROTEIN STRUCTURE PREDICTION & MODELLING: Methods for Secondary structure prediction: Chou Fasman and GOR; Protein structures evaluation (Procheck); Software for Secondary structure prediction.; Protein Modelling: Methods of Protein Modelling, Homology Modelling, Threading or fold recognition and Ab-initio structure prediction methods.; Tools for Protein structure prediction (Predict Protein); Tools for protein	Teaching Hours :15

	structure modelling – Swiss Model.	
Reference Books	• S. C. Rastogi, N. Mendiratta and P. Rastogi, 2nd Edition "Bioinformatics: Concepts, Skill & Applications", CBS publisher & Distributor, 2009. • Mount, D.W., "Bioinformatics: Sequence and Genome analysis", Cold Spring Harbour Laboratory Press, 2001. • Zhumur Gosh and Bibekanand Mallick "Bioinformatics: Principle and Application", Oxford University Press, 2008. • Simminder Kaur Thukral and Orpita Bosu, Pap/Cdr edition, "Bioinformatics: Database, Tools and Algorithms", Oxford University Press, USA, 2007. • N. J. Chikhale and V.S. Gomase, 1st Edition, "Bioinformatics: Theory & Practices", Himalaya Publishing House Limited, 2007. • Lesk, A. K., "Introduction to Bioinformatics" 4th Edition, Oxford University Press, 2013.	
e-learning resources	https://en.wikipedia.org/wiki/List_of_protein_structure_prediction_software https://predictprotein.org/ https://en.wikipedia.org/wiki/List_of_phylogenetics_software	
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment	
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-2503001305041004]

BTP-ME-502: Advances in Bioinformatics Practical

Course Code	BTP-ME-502
Course Title	**Advances in Bioinformatics Practical**
Credit	2
Course Level	300-399
Total Engagement	2 Credits x 30 Hours = 60 Hours
Teaching per Week	4 h
Minimum weeks per Semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)
Effective From	2025-2026
Purpose of Course	The students will become familiar with the use of a wide variety of internet applications using various tools used for phylogenetic analysis and protein prediction.
Course Objective	The objective of this course is to provide students with practical experience of use of common computational tools and databases which are used to investigate molecular and evolution concepts
Course Outcomes	CO1: Students will learn about how to retrieve sequence and structure from different biological databases. CO2: Students will learn about how to download .pdb file protein data Bank. CO3: Students will learn about how to get various information from different metabolic pathway. CO4: Students will learn about how to display .pdf file and analysis it. CO5: Students will learn about how to perform similarity

<table>
<tr><td></td><td colspan="9">& homology Search. CO6: Students will learn about how to perform multiple sequence analysis by Clustal family. CO7: Students will learn about how to perform cladogram/dendogram from various computational tools. CO8: Students will learn about how to build protein model by using swiss model. CO9: Students will learn about how to find out active site of protein.CO10: Students will learn about various tools and techniques for evaluation of protein structures.</td></tr>
<tr><td rowspan="2">Mapping between COs with PSOs</td><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><td></td></tr>
<tr><td>CO1 to 10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pre-requisite</td><td colspan="9">Basic of Biology, Biotechnology, Biochemistry, Microbiology</td></tr>
<tr><td>Course Content</td><td colspan="8">1. Nucleotide and protein Sequence retrieval from NCBI/EMBL
2. Protein Structure retrieval from Protein Data Bank (PDB)
3. Exploring information from metabolic pathway database
4. Protein structure visualization by RasMol
5. Pairwise sequence alignment using BLAST/FASTA
6. Multiple sequence alignment using Clustal Omega/Clustal X
7. Creation of Cladogram / Phylogram using NJ and UPGMA method
8. Perform homology modelling using Swiss model
9. Analysis of Binding Site of Protein
10. Evaluation of predicted structure by Procheck and Ramachandran Plot</td><td>Teaching Hours :60</td></tr>
<tr><td>Reference Books</td><td colspan="9">• S. C. Rastogi, N. Mendiratta and P. Rastogi, 2nd Edition “Bioinformatics: Concepts, Skill & Applications”, CBS publisher & Distributor, 2009.
• Zhumur Gosh and Bibekanand Mallick “Bioinformatics: Principle and Application”, Oxford University Press, 2008.
• Simminder Kaur Thukral and Orpita Bosu, Pap/Cdr edition, “Bioinformatics: Database, Tools and Algorithms”, Oxford University Press, USA, 2007.</td></tr>
<tr><td>e-learning resources</td><td colspan="9">• https://www.ncbi.nlm.nih.gov/
• https://www.rcsb.org/
• https://www.genome.jp/kegg/
• https://blast.ncbi.nlm.nih.gov/Blast.cgi
• https://www.ebi.ac.uk/thornton-srv/software/PROCHECK/
• https://swissmodel.expasy.org/</td></tr>
<tr><td>Teaching Methodology</td><td colspan="9">Classwork, Discussion, Self-Study, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td colspan="9">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

Undergraduate Program (Science Faculty)

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

Semester-V

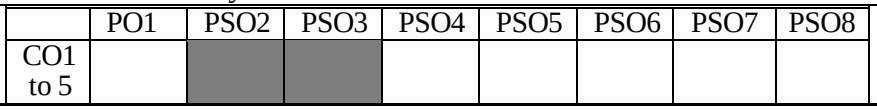
Course: BT-ME-503: Enzymology

Course Code	BT-ME-503
Course Title	**Enzymology**
Credits	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The purpose of the course is to give knowledge to the students regarding the fundamentals of Enzymology.
Course Objectives	The objective is to explain students about what are enzymes, how they function and their industrial applications.
Course Outcomes	CO1: Students would be able to get details about what are enzymes and how they function. CO2: Students would get insights about enzyme kinetics and their applications.
Mapping between COs with PSOs	<table><tr><th></th><th>PSO1</th><th>PSO2</th><th>PSO3</th><th>PSO4</th><th>PSO5</th><th>PSO6</th><th>PSO7</th><th>PSO8</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>
Pre-requisite	Biology, Biotechnology, Biochemistry, Microbiology
Course Content	**UNIT-1: Basics of Enzymology.** Introduction and Historical background, nomenclature and classification, coenzyme, cofactor, apoenzyme, holoenzyme Physical and chemical properties of enzyme, Factors affecting enzyme activity, Active site, Mechanism of enzyme action, Lock and key model, Induced fit model. — Teaching Hours: 15 **UNIT-2: Enzyme Kinetics.** Order of reaction, Michaelis Menten equation, significance of Km and Vmax, LB plot, Hans plot, Eadie hofstee plo Enzyme inhibitors (competitive, uncompetitive, non competitive), Enzyme units, Industrial application of enzymes. — Teaching Hours: 15
Reference Books	• Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2005). Lehninger principles of biochemistry. Macmillan. • T. Devasena (2015) Enzymology, Oxford university Press. • T. Palmer (2007), Enzyme Biochemistry, Biotechnology and Clinical Enzymology, Woodhead Publishing Limited.
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment

Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.

[Subject Code-2503001305041006]

Course: BTP-ME-503: Enzymology Practical

Course Code	BTP-ME-503
Course Title	**Enzymology Practical**
Credits	2
Course Level	300-399
Total engagement	4 h x 15 weeks = 60 Hours
Teaching per week	4 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The purpose of the course is to familiarize students to work with enzymes.
Course Objectives	To familiarize students about how enzyme function, enzyme units and enzyme kinetics. .
Course Outcomes	CO1: Students will learn about importance of standard curve, for estimating enzyme activity. CO2: Students will get insights about estimation of enzyme units. CO3: Students will gain insights about how incubation temperature affects enzyme activity. CO4: Students will gain insights about how pH affects enzyme acticity. CO5: Students will learn to calculate important kinetic parameters like Km and Vmax of enzyme.
Mapping between COs with PSOs	
Pre-requisite	Biology, Biotechnology, Biochemistry, Microbiology.
Course Content	1. Estimation of reducing sugar by DNSA method (standard graph of invert sugar) 2. Determination of units of Enzyme (Invertase) 3. Determination of optimum temperature on enzyme activity. 4. Determination of optimum pH on enzyme activity. 5. Determination of Km and Vmax using substrate vs velocity plot. Teaching Hours: 60
Reference Books	• Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2005). Lehninger principles of biochemistry. Macmillan. • T. Devasena (2015) Enzymology, Oxford university Press. • T. Palmer (2007), Enzyme Biochemistry, Biotechnology and Clinical Enzymology, Woodhead Publishing Limited.
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.

[Subject Code-2503001305041007]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester V

Course: BT-ME-504: Introduction to Nanobiotechnology

Course Code	BT-ME-504	
Course Title	**Introduction to Nanobiotechnology**	
Course Level	300-399	
Credit	02	
Total engagement	02 Credits x 15 Hours = 30 Hours	
Teaching per week	02 Hours	
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)	
Effective from	2025-2026	
Purpose of Course	The course is designed to provide knowledge regarding different aspects of Nanobiotechology. It is an emerging field with applications in diverse filed related to biotechnology. This course will familiarise learner with different synthesis methods, molecular nanobiotechnology and application of nanomaterials.	
Course Objective	• To make students aware about different the field of nanobiotechnology along with different synthesis methods. • To discuss the application of nanomaterials like DNA, proteins and CNT in the field of biotechnology.	
Course Outcomes	• The students will gain knowledge about the field of nanobiotechnology and different methods applicable for synthesis of nanoparticles. • The students will get information about nanobiotechnological application of biomolecules (DNA and Proteins) and Carbon Nano tubes (CNT).	
Mapping between COs with PSOs		
Pre-requisite	Basic Knowledge of Biology and Biochemistry	
Course Content	**UNIT 1: Introduction and Synthesis of Nonmaterial:** Introduction to Nanobiotechnology, Types and Properties of Nanomaterials, Approaches (Top-down and Bottom-up) and Techniques (Physical: Ball milling, Thermal or flame synthesis, Spray pyrolysis, Laser Ablation and Arc discharge; Chemical: Sol-gel, Sonochemistry, Photochemical, Nanoprecipitation, Chemical Vapour Deposition; Biological or Biosynthesis) synthesis of Nanoparticles, Stability of Nanoparticle, Introduction to Nanolithography (Soft lithography, Photolithography, Magnetolithography, Nanoimprint, Dip Pen, Enzymatic nanolithography) for Self-assembly of nanomaterials.	Teaching Hours: 15

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

	UNIT 2: Molecular Nanotechnology and Application of Nanomaterials: DNA as nanostructure (structural forms of DNA), DNA tweezers and FRET technology, Self-assembly Proteins (Protein cages: Dps, Ferritin, Virus capsid and Protein rings: Phage recombinase, TRAP), Application of protein nanostructure, Introduction and properties of Carbon nanotubes (CNT), Application of CNT in diagnostic equipment, Gene delivery (liposomes), Cancer treatment, Photocatalysis of pollutants using nanomaterial, Application of Nanomaterials in food and agriculture.	Teaching Hours: 15
Reference Books	• Goodshell, David S. Biotechnology: Lessons from Nature. John Wiley & sons, 2004 • Sharon Madhuri et al Bio-nanotechnology, Ane Books Pvt. Ltd., 2014 • Kulkarni, Sulabha K. Nanobiotechnology: Principles and Practices. Springer, 2014	
e-learning resources	• Bochman, M., Paeschke, K. & Zakian, V. DNA secondary structures: stability and function of G-quadruplex structures. Nat Rev Genet 13, 770–780 (2012). https://doi.org/10.1038/nrg3296 • Lapenta, F., Aupič, J., Vezzoli, M. et al. Self-assembly and regulation of protein cages from pre-organised coiled-coil modules. Nat Commun 12, 939 (2021). https://doi.org/10.1038/s41467-021-21184-6	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination	

[Subject Code-2503001305041008]

BTP-ME-504: Introduction to Nanobiotechnology Practical

Course Code	BTP-ME-504
Course Title	**Introduction to Nanobiotechnology Practical**
Course Level	300-399
Credit	02
Total engagement	02 Credits x 30 Hours = 60 Hours
Teaching per week	04 Hours
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	To provide practical understanding regarding synthesis and characterisation of nanoparticles.
Course Objective	To educate and give practical exposure about laboratory scale production of nanoparticles and its characterisation.
Course Outcomes	CO1-3: Student will be able to synthesis nanoparticles using different methods. CO4: This practical will allow students to analysis nanoparticles on the basis of its optical property.

<table>
<tr><td></td><td colspan="2">CO5: One of the possible application of nanoparticles is to use it as antimicrobial agent. This practical will give student hands on experience to test antimicrobial activity of prepared nanoparticles.
CO6: Student will learn to study nanoparticles using various tools.
CO7: This Practical will create awareness regarding different techniques that can be used for the characterisation of nanoparticles.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="2"><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 to 07</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="2">Basic Knowledge of Biology and Biochemistry</td></tr>
<tr><td>Course Content</td><td>1. Synthesis of metal nanoparticles using sodium citrate (Chemical method).
2. Synthesis of nanoparticles using fungal/bacterial cell (biological method).
3. Synthesis of nanoparticles using plant extract (biological method).
4. Analyse nanoparticles using UV-Vis spectrophotometer.
5. In vitro study to confirm antimicrobial activity of nanoparticles against bacteria.
6. Study of nanoparticles by using Image J Analysis Tool.
7. Awareness (Visit/Demonstration) about different methods (FTIR, Microscopy and Particle size analysis) for characterisation of nanoparticles.</td><td>Teaching Hours: 60</td></tr>
<tr><td>Reference Books</td><td colspan="2">• Gérrard Eddy Jai Poinern, A Laboratory Course in Nanoscience and Nanotechnology, CRC Press Taylor & Francis Group, LLC, 2015.</td></tr>
<tr><td>e-learning resources</td><td colspan="2">• https://doi.org/10.1039/D0MA00807A
• https://doi.org/10.1186/s12951-022-01477-8
• https://doi.org/10.1039/C8NR02278J</td></tr>
<tr><td>Teaching Methodology</td><td colspan="2">Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment</td></tr>
<tr><td>Evaluation Method</td><td colspan="2">50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.</td></tr>
</table>

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty):
Skill Enhancement Course

Teaching & Evaluation Scheme
Semester-V & VI
[Academic Year of Implementation 2025-2026]

Semester-V

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-SEC-501	Separation Techniques in Molecular Biology	1	00:30	13	12	25	1
BTP-SEC-501	Separation Techniques in Molecular Biology: Practical	2	03:00	12	13	25	1
	Total	**3**	**03:30**	**25**	**25**	**50**	**2**

Semester-VI

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
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---	---	---	---	---	---	---	---

[Subject Code for Theory -2503001305066001]
[Subject Code for Practical-2503001305066002]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-V

Skill Enhancement Course: BT-SEC-501: Separation Techniques in Molecular Biology

Course Code	BT-SEC-501/ BTP-SEC-501	
Course Title	**Separation Techniques in Molecular Biology**	
Credits	2	
Course Level	300-399	
Total engagement	1 Credits x 15 Hours + 1 Credit x 30 Hours = 45 Hours	
Teaching per week	3 h	
Minimum weeks per semester	15 weeks (Including class work, examination, preparation & holidays)	
Effective from	2025-26	
Purpose of Course	This course is to provide students with a comprehensive understanding of electrophoretic techniques and their applications in molecular biology and biochemistry.	
Course Objectives	- To introduce students to the fundamental principles of electrophoresis - To explore various types of electrophoresis, such as agarose gel electrophoresis, polyacrylamide gel electrophoresis (PAGE) - To provide hands-on experience with electrophoretic techniques, including sample preparation, gel casting, running electrophoresis, and staining/destaining procedures.	
Course Outcomes	CO1: Students will demonstrate a thorough understanding of the principles and mechanisms underlying electrophoretic techniques for DNA, RNA and Protein separation. CO2: Students will gain hands-on experience and technical proficiency in preparing and running various gel electrophoresis for separation and analysis of Nucleic acid and Protein.	
Mapping between COs with PSOs		
Pre-requisite	Biology; Chemistry, Physics	
Course Content	**UNIT-1: Electrophoretic Techniques** General Principles, Support media and Buffers, Electrophoresis of Protein (SDS-PAGE, Native gels, Gradient gels, Detection, Estimation and Recovery of Proteins in Gels), Electrophoresis of Nucleic acids (Agarose Gel Electrophoresis of DNA, DNA Sequencing Gels, Electrophoresis of RNA).	Teaching Hours: 15
	UNIT-2: Practical 1. Preparation of Agarose gel. 2. Separation of DNA using Agarose Electrophoresis. 3. Elution of DNA fragment from Agarose gel. 4. Quantitative determination of DNA and RNA by Spectroscopic method.	Teaching Hours: 30

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

	5. Separation of protein using SDS-PAGE (Demonstration).	
Reference Books	• Aneja, K. (2014). Laboratory Manual of Microbiology and Biotechnology (1st ed.). MedTech. • Michov, B. (2022). Electrophoresis Fundamentals: Essential Theory and Practice. De Gruyter. • Sengar, G. S. (2011). Laboratory Manual on Biotechnology. Studium Press Pvt. Ltd. • Wilson, W. (2018). Principles and Techniques of Biochemistry and Molecular Biology (8th ed.). Cambridge University Press.	
e-learning resources	• https://www.youtube.com/dbtvnsgu • https://www.bio-rad.com	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.	

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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંક :ઓથો./પરિપત્ર/૧૨૧૭૭/૨૦૨૫
તા.૩૦/૦૫/૨૦૨૫

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

વિષયઃ– M.Sc.(5 years Integrated) Biotechnology Sem.-5 Skill Enhancement Course-Food Packaging & Preservation Technology નાં અભ્યાસક્રમ અંગે.

મહાશય,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર M.Sc.(5 years Integrated) Biotechnology Sem.-5 Skill Enhancement Course-Food Packaging & Preservation Technology નો નિયુક્ત પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ અંગે બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૯/૦૪/૨૦૨૫ની સભાના ઠરાવ ક્રમાંકઃ૦૪ થી કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૪ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૮ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

કુલસચિવ

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

.....તરફ જાણ તેમજ અમલ સારૂ.

[Subject Code-2503001305066003]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program (Science Faculty)

(3 Years B. Sc. Degree; 4 Years B. Sc. with Honours/Honours with Research)

Semester-V

Skill Enhancement Course: BT-SEC-502: Food Packaging & Preservation Technology

Course Code	BT-SEC-502
Course Title	**Food Packaging & Preservation Technology**
Credit	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 hours
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	This course is designed to provide students with a comprehensive understanding of the principles, techniques, and technologies involved in packaging and preserving food products. The course aims to equip students with the knowledge and skills necessary to ensure the safety, quality, and extended shelf-life of food through proper packaging and preservation methods.
Course Objective	The purpose of this course is to give students an understanding of the basics of food preservation and food packaging. The students will learn about numerous techniques for extending the shelf life of different food products.
Course Outcomes	CO1: Students will be able to analyse the requirements of packaging materials, classify different packaging materials, understand the interaction between packaging materials and foods, design packaging systems, ensure packet closure and integrity, and evaluate the environmental impacts of packaging. CO2: Students will be able to recognize and understand the sources of contamination and signs of spoilage specific to eggs, vegetables, fruits, sugars and sugar products, fish and other seafood, milk and milk-based products, and miscellaneous food items. Students will be also able to understand and apply the general principles of food preservation, including preservation by high and low temperature, drying, food additives and radiation.
Mapping between COs with PSOs	
Pre-requisite	Basic Science

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

Course Content	**UNIT-1: Food Packaging:** Requirements of packaging materials, Classification and Properties of Packaging Materials, Interaction between packaging materials and foods, Packaging systems, Packet closure and integrity, Environmental impacts of packaging, Introduction types of packaging: Primary, Secondary, Tertiary, Modified Atmosphere Packaging (MAP), Intelligent, Smart, Active Packaging Systems. Safety and legislative aspects of packaging: Regulatory considerations, plastic, metal, paper and glass packaging.	Teaching Hours: 12 h
	UNIT-2: Food Spoilage and Preservation: **a. Spoilage of Food** Types of contamination: Biological, chemical & physical, sources, types and perishability of foods; Causes and types of food spoilage; Factors affecting food spoilage – extrinsic and intrinsic factors, Foodborne illness. **b. Food Preservation** General Principles of Food Preservation, Preservation by Heat treatment (blanching, canning, pasteurization & sterilization), Preservation by Low Temperature, Preservation by Drying & Dehydration, Preservation by Salt and Sugar, Preservation by Chemicals: Antioxidants, mould inhibitors, acidulants, Hurdle technology. Preservation by Irradiation, Overview on non-thermal preservation processes: Pulsed electric field, high pressure processing, microwave processing, ultrasound, ohmic heating, infrared heating.	Teaching Hours: 18 h
Reference Books	• Campbell-Plat, G. 1st Edition, (2010). Food Science & Technology, Wiley-Blackwell. ISBN 978-0-632-06421-2. • Frazier, W.C., & Westhoff, D.C. (1988). Food Microbiology. McGraw-Hill. ISBN 978-1-259-062513 • James M. Jay, Martin J. Loessner, David A. Golden (2005). 7th Edition, Modern Food Microbiology, Springer. ISBN 978-81-8128-528-7.	
e-learning resources	• https://link.springer.com/book/10.1007/978-1-4419-0826-1 • https://www.vivekanandcollege.ac.in/uploads/dptmicrobiology/ebooks/food-microbiology-by-wc-frazier-.pdf • https://zlib.pub/book/food-science-and-technology-5oq0stv3fi30 • https://bcs.wiley.com/hebcs/Books?action=index&bcsId=5112&itemId=0632064218	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.	

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
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-: પરિપત્ર :-

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર T.Y.B.Sc. English Sem.-5 & 6 નો AEC અને SEC નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ અંગ્રેજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિ વતી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૩ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/સિલેબસ/૧૧૯૯૮/૨૦૨૫
તા.૨૬–૦૫–૨૦૨૫

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

NEP – 2020 GUIDED

SYLLABUS FOR SKILL ENHANCEMENT COURSE (SEC)

ADVANCED COMMUNICATION SKILLS IN ENGLISH -V

FOR B.A / B.COM. / B.SC./B.SC.COMP.SC. (REGULAR)

SEMESTER V

FOR THE ACADEMIC YEARS 2025-26 TO 2027-28

Dr. G. K Nanda

B.A./ B.COM. /B.SC./B.SC.COMP.SC. SEM 5 :TEXT : ***Aspirations* :*English for Careers*(OB)**

<table>
<tr><td>Course Code</td><td></td></tr>
<tr><td>Course Title</td><td>Advanced Communication Skills in English -V</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 hours</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15(including class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2025</td></tr>
<tr><td>Purpose of Course</td><td>To promote personal, social and professional communications effectively.</td></tr>
<tr><td>Course Objective</td><td>This course aims to improve employability, equip students with industry-relevant skills, and foster personal and professional course, ultimately contributing to individual and societal advancement.</td></tr>
<tr><td>Course Outcomes</td><td>After completing the course the students would be able to:
CO1: develop employability skills leading to enhance job readiness.
CO2: improve communication and team work, problem solving abilities, and increased career success.
CO3:boost career prospects and job satisfaction.</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></tr><tr><td>CO1</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></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td>Acquaintance with basic grammar and language skills</td></tr>
<tr><td>Course Content</td><td>TEXTBOOK: Aspirations :English for Careers(OB)

Unit 1: English for competitive examinations
• Vocabulary
• Tenses
• Prepositions</td></tr>
</table>

	Unit 2: A) English for Research Purposes • Research writing : Nature and Conventions • Research Proposal Format • Strategies for writing Effective Research Proposals • Format of Research Papers **Unit 2: B) Content Writing** • Writing Blogpost and Online Articles • Writing for Websites • Writing for Social media platforms **Unit 2:C) English for Advertising** • Writing Newspaper Advertisement • Writing Television and Radio Advertisements • Writing Internet Advertisements
Reference Books	**1)** Murphy, Raymond. *English Grammar in Use*. CUP **2)** Quirk, Randolp, et.at. *A Comprehensive Grammar of the English Language*. Pearson Education Limited **3)** Yule, George. *Explaining English Grammar*. OUP **4)** Lester ,James D.AND James D. Lester, Jr. *Writing Research Papers: A Complete Guide.* Pearson Education Limited,2015. **5)** Wallwork, Adrin. *English for Writing Research Papers.* Springer **6)** Redish, Janice.*Letting Go of the Words*: *Writing Web Content that Works*. Morgan Kaufmann. **7)** Schwab, Victor O . *How to write a good advertisement* : *A Short Course in Copywriting*. Martino Publishing
Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Testmarks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination.

Distribution of Marks for the University Examination as per NEP SOP

Q 1. Ten MCQs from Unit 1	10 Marks
Q 2. A. Theoretical questions from exercise to be answered in about 150 words from Unit 2 A (1/2)	05 Marks
B. Practical question from Unit 2 B (1/2) (to write a blog/online article / article for website/ content to be posted in social media platforms)	05 Marks
C. Practical questions from Unit 2 C (1/2) (Analyze a popular ad **OR** design classified newspaper ads/ design T.V. or Radio ads/design google ads/ design facebook adds)	05 Marks
	Total 25 Mark

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ક્રમાંક :ઓથો./પરિપત્ર/૬૨૨/૨૦૨૫
તા.૧૭/૦૩/૨૦૨૫

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

વિષયઃ– NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ .

સુજ્ઞ શ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ અભ્યાસક્રમ બનાવવામાં આવેલા કોર્ષ અંગે ચર્ચા કરી બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે નીચે મુજબ કરેલ ભલામણ પર વિચારણા કરતા વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩૬ થી સ્વીકારી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણને એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૫ થી સ્વીકારી મંજુર કરેલ છે, જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

<u>બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ ૨</u>

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

<u>વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૩</u>

:: આથી ઠરાવવામાં આવે છે કે, બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૭/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ અન્વયે કરેલ ભલામણ સ્વીકારી શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬ નો અભ્યાસક્રમ મંજૂર કરવા એકેડેમિક કાઉન્સિલને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૦૪/૦૩/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૫

:: આથી ઠરાવવામાં આવે છે કે, NEP-2020 અંતર્ગત નવા ક્રેડિટ સ્ટ્રક્ચર મુજબ બાયોટેકનોલોજી પ્રોગ્રામનાં સેમેસ્ટર–૫ અને ૬નો અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૧૮/૦૨/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૨ થી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૨૭/૦૨/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૦૩ થી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ

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 Specific Outcomes (PSOs):

1. PSO-01: 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. PSO-02: 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. PSO-03: 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. PSO-04: Knowledge of biotechnological techniques and applications: Students will learn about the latest advancements in biotechnology, including genetic engineering, gene therapy, bio-molecular engineering, biostatistics and synthetic biology. Learners understand how these techniques can be applied in various sectors such as healthcare, agriculture, environmental science and pharmaceuticals.
5. PSO-05: 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. PSO-06: 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. PSO-07: 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. PSO-08: 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.

Semester-VI

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-MJ-601	Microbial Biotechnology	2	1:00	25	25	50	2
BTP-MJ-601	Microbial Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-602	Plant Tissue Culture Techniques	2	1:00	25	25	50	2
BTP-MJ-602	Plant Tissue Culture Techniques: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-603	Animal Biotechnology	2	1:00	25	25	50	2
BTP-MJ-603	Animal Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**18**	**21**	**150**	**150**	**300**	**12**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-VI

Course: BT-MJ-601: Microbial Biotechnology

Course Code	BT-MJ-601
Course Title	**Microbial Biotechnology**
Credits	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-26
Purpose of Course	Microbial Biotechnology is intended to provide the student with a working knowledge of the Microorganisms and their role in biotechnological process such as Fermentation. The course involved discussion from designing of fermenter to strain improvement for fermentation industries.
Course Objectives	• To understand the commercial applications of microorganisms. • To learn concept of isolating enzyme and antibiotic producing microorganisms. • Acquire the ability and knowledge to isolate and screen the commercially important bacteria from different sources. • Understand how microbes are useful to human beings and how their products are commercialized. • The designing of fermenter and role of each component will be explored.
Course Outcomes	**CO1**: Apply knowledge of microbial biotechnology to design, optimize, and analyse fermentation processes for industrial applications. **CO2**: Demonstrate the ability to isolate, screen, and enhance microorganisms for the production of commercially important bio-products.
Mapping between COs with PSOs	

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

Pre-requisite	Basic Microbiology and Biotechnology	
Course Content	**UNIT-1:** **INTRODUCTION TO MICROBIAL FERMENTATION** Concept of fermentation technology, Chronological development of industrial fermentation technology, Range of fermentation processes and products, Fermentation process outline, Fermentative production of Citric acid, Ethanol and Penicillin (Outline)	Teaching Hours: 15

	MICROBIAL SCREENING AND PRESERVATION Concept of microbial screening, Primary and Secondary screening, Isolation of industrially important microorganisms: Methods utilizing selection of desired characteristics, Methods not utilizing selection of desired characteristics, Future potential and needs of microbial screening, Maintenance and Preservation of Microbial cultures	
	UNIT-2: IMPROVEMENT OF MICROORGANISMS Types of Microbial mutants and their practical implications, Isolation of microbial mutants (Outline), Selection of mutants producing high yield of primary & secondary metabolites, Parasexual cycle, Protoplast fusion **FERMENTER DESIGN** Basic functions of fermenter, Aseptic operation and Containment, Factors involved in fermenter design, Typical batch fermenter, Air-lift bioreactor and CSTF	Teaching Hours: 15
Reference Books	• Stanbury PF, Whitaker A. Hall SJ. Principles of fermentation technology. Elsevier: 2013 Oct 22. • Crueger W, Crueger A. Biotechnology: A Textbook of Industrial Microbiology. Madison: Sinauer Tech.; 1989. • Patel AH. Industrial microbiology. Macmillan India; 1984. • Patel, R., & Patel, K. (2022). *Lecture notes on Introduction to Microbiology*. Aditya Publication.	
e-learning resources	• https://4lfonsina.wordpress.com/wp-content/uploads/2012/11/industrial-microbiology-an-introduction-0632053070-wiley.pdf • https://microbenotes.com/bioreactor/	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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-2603001306011002]

BTP-MJ-601: Microbial Biotechnology Practical

Course Code	BTP-MJ-601
Course Title	**Microbial Biotechnology Practical**
Credits	2
Course Level	300-399
Total engagement	2 Credit x 30 Hours = 60 Hours
Teaching per week	4 Hours
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-26

Purpose of Course	The course is designed to equip students with hands-on experience and technical skills in isolating, screening, and characterizing microorganisms for their ability to produce extracellular enzymes, antibiotics, and commercially valuable products. It also emphasizes understanding fermentation techniques and their applications in industrial microbiology.
Course Objectives	• To develop the ability to isolate and screen microorganisms for the production of enzymes and antibiotics. • To understand and apply techniques for studying antibiotic resistance in microorganisms. • To acquire practical knowledge of aerobic and anaerobic fermentation processes and their applications in the production of bio-products such as citric acid and ethanol. • To learn the methods for the estimation of bio-products and demonstrate the working principles of fermenters.
Course Outcomes	**CO1:** Students will gain knowledge on how to isolate and screen microorganisms for the production of industrially important enzymes like amylase and protease, and will understand their applications in various industries such as food, pharmaceuticals, and textiles. **CO2:** Students will acquire insights into the identification and evaluation of cellulase and lipase producers, and will understand their roles in biofuels, detergents, and waste management. **CO3:** Students will understand the application of the Gradient Plate Technique to study antibiotic resistance, and will gain knowledge of its significance in understanding microbial resistance mechanisms. **CO4:** Students will gain the ability to use the Replica Plate Technique to identify and analyse antibiotic-resistant mutants, and will understand its importance in microbial genetics and resistance studies. **CO5:** Students will acquire skills in screening microorganisms for antibiotic production using methods such as the Crowded Plate and Wilkin's techniques, and will understand their relevance in discovering new antibiotic sources. **CO6:** Students will gain the ability to prepare and interpret a standard curve for citric acid quantification, and will understand its importance in the assessment of fermentation processes in industrial applications. **CO7:** Students will understand the process of aerobic fermentation for citric acid production, and will gain knowledge of its applications in industrial bioprocess optimization. **CO8:** Students will learn to estimate alcohol concentration in fermentation samples using iodometric titration, and will gain an understanding of its role in ensuring fermentation quality and accuracy. **CO9:** Students will gain insights into performing anaerobic fermentation to produce ethanol, and will understand the significance of bioethanol production in sustainable energy solutions.

<table>
<tr><td></td><td colspan="2">CO10: Students will acquire a comprehensive understanding of fermenter design and operation, and will learn how different components influence industrial bioprocesses and scalability.</td></tr>
<tr><td>Mapping between COs with PSOs</td><td colspan="2"><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 to 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 colspan="2">Biology, Basic Chemistry</td></tr>
<tr><td>Course Content</td><td>1. Isolation and Screening of Extracellular enzyme producing Microorganisms: Amylase and Protease Producer
2. Isolation and Screening of Extracellular enzyme producing Microorganisms: Cellulase and Lipase Producer
3. Isolation of antibiotic-resistant mutant by Gradient Plate Technique (GPT).
4. Isolation of antibiotic-resistant mutant by Replica Plate Technique (RPT).
5. Isolation and screening of antibiotic producing microorganisms.
a. Crowded Plate Technique
b. Wilkin’s Technique
6. Preparation of standard curve for Citric acid.
7. Aerobic Fermentation of Citric acid by Eukaryotic Microorganisms.
8. Estimation of Alcohol by iodometric titration method.
9. Anaerobic Fermentation of Ethanol by Eukaryotic Microorganisms.
10. Demonstration of Fermenter.</td><td>Teaching Hours: 60 h</td></tr>
<tr><td>Reference Books</td><td colspan="2">• Aneja, K. (2014). Laboratory Manual of Microbiology and Biotechnology (1st ed.). MedTech.
• Patel, R., & Patel,K P. (2016) Experimental Microbiology (9 ed., Vol. I). Aditya Publication.</td></tr>
<tr><td>e-learning resources</td><td colspan="2">• https://www.youtube.com/watch?v=XApUZukvbmQ</td></tr>
<tr><td>Teaching Methodology</td><td colspan="2">Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment</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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-VI

Course: BT-MJ-602 Plant Tissue Culture Techniques

Course Code	BT-MJ-602
Course Title	**Plant Tissue Culture Techniques**
Credits	2
Course Level	300-399
Total Engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2 hours
Minimum weeks Per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The purpose of the "Plant Tissue Culture Techniques" course is to provide students with a foundational understanding of plant tissue culture techniques and their applications in plant biotechnology. This course aims to explore key concepts such as totipotency, micropropagation, and genetic regeneration, focusing on the practical use of these technologies in plant breeding, conservation, and crop improvement. The course also addresses the challenges and innovations in plant tissue culture, equipping students with the knowledge to apply these techniques in research and industry settings.
Course Objective	The objective of the " Plant Tissue Culture Techniques" course is to provide students with a comprehensive understanding of the fundamental principles and techniques used in plant tissue culture. The course aims to introduce key concepts such as totipotency and its applications in biotechnology, while covering essential techniques like micropropagation, somatic embryogenesis, and protoplast isolation. Students will explore advanced topics including synthetic seed technology, cryopreservation for genetic resource conservation, and the role of plant tissue culture in plant breeding and conservation.
Course Outcomes	Upon completion of the Plant Tissue Culture Techniques Course, students will: CO1: Students will have a solid understanding of the fundamental principles and techniques in plant tissue culture. They will be able to apply concepts of totipotency in plant biotechnology, utilize micropropagation methods for plant regeneration, and distinguish between direct and indirect organogenesis. CO2: Students will gain an in-depth understanding of advanced biotechnological techniques used in plant regeneration and genetic resource conservation. They will learn about the processes and applications of androgenesis and gynogenesis in plant breeding, as well as the role of embryo culture in enhancing crop varieties. The unit will also cover the isolation and culturing of protoplasts, synthetic seed technology for mass propagation, and

<table>
<tr><td></td><td colspan="10">the techniques of cryopreservation for long-term storage of plant genetic resources.</td></tr>
<tr><td rowspan="3">Mapping between Cos with PSOs</td><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>Pre-requisite</td><td colspan="10">Basic Biology</td></tr>
<tr><td rowspan="2"></td><td colspan="9">UNIT-1: Fundamentals of Plant Tissue Culture and Micropropagation: Introduction & General Techniques of Plant tissue culture, Totipotency in Plant Biotechnology: Techniques and Implications, Principles and Applications of Micropropagation, Micropropagation Methods: Direct and Indirect Organogenesis</td><td>Teaching Hours: 15</td></tr>
<tr><td colspan="9">UNIT-2: Applications of Biotechnology in Plant Regeneration and Preservation: Androgenesis and Gynogenesis: Applications and Key Factors, Embryo Culture in Plant Breeding and Biotechnology, Protoplast Isolation and Culturing Techniques, Synthetic Seed Technology & Cryopreservation: Methods, Challenges, and Applications</td><td>Teaching Hours: 15</td></tr>
<tr><td>Reference Books</td><td colspan="10">• Chawla, H. S. (2011). Introduction to plant biotechnology (3/e). CRC Press.
• Bhojwani, S. S., & Razdan, M. K. (1986). Plant tissue culture: theory and practice. Elsevier.
• Jha, T. B. (2005). Plant tissue culture: basic and applied. Universities press.
• Veeresham, C., & Kokate, C. K. (2006). Medicinal plant biotechnology. CBS Publishers and Distributers.
• Razdan, M. K. (2002). An introduction to plant tissue culture. Oxford and IBH publishing.</td></tr>
<tr><td>e-learning re-sources</td><td colspan="10">• Thorpe, T.A. (2007) ‘History of plant tissue culture’, Molecular Biotechnology, 37(2), pp. 169–180. Available at: https://doi.org/10.1007/s12033-007-0031-3.
• Dagla, H.R. (2012) ‘Plant tissue culture: Historical developments and applied aspects’, Resonance, 17(8), pp. 759–767. Available at: https://doi.org/10.1007/s12045-012-0086-8.
• Al-Khayri, J.M., Jain, S.M. and Johnson, D. V. (2016) Advances in plant breeding strategies: Breeding, biotechnology and molecular tools, Advances in Plant Breeding Strategies: Breeding, Biotechnology and Molecular Tools. Available at: https://doi.org/10.1007/978-3-319-22521-0.</td></tr>
<tr><td>Teaching Methodology</td><td colspan="10">Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment Laboratory work, Journal preparation</td></tr>
<tr><td>Evaluation Method</td><td colspan="10">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>

[Subject Code-2603001306022002]

BTP-MJ-602: Plant Tissue Culture Techniques Practical

Course Code	BTP-MJ-602
Course Title	**Plant Tissue Culture Techniques Practical**
Credits	2
Course Level	300-399
Total Engagement	2 Credits x 30 hours = 60 hours
Teaching per week	2 hours
Minimum weeks Per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The Purpose of Plant Tissue Culture Techniques practical is to provide undergraduate students with hands-on experience in various plant tissue culture techniques, enhancing their understanding of plant growth and development *in vitro*.
Course Objective	The Objective of these practical is to introduce undergraduate students to fundamental plant tissue culture techniques, including the preparation of growth media and the inoculation of various plant explants. These activities aim to enhance their skills in plant biotechnology, genetic manipulation, and tissue culture applications in plant breeding and conservation.
Course Outcomes	Upon completion of the Basics of Plant Tissue Culture Techniques Practical, students will: 1. Gain knowledge of essential equipment, tools, and techniques for setting up a tissue culture lab. 2. Gain the ability to prepare MS medium and understand its role in plant tissue culture for tissue regeneration. 3. Develop skills in inoculating various explants into MS medium and analyzing their growth and development. 4. Acquire the skills to prepare B5 medium and apply it for growing plant cells and tissues. 5. Inoculate explants into B5 medium and monitor their growth and differentiation. 6. Develop expertise in isolating protoplasts through Enzymatic methods for experimental applications. 7. Develop expertise in isolating protoplasts through mechanical methods for experimental applications. 8. Understand the process of anther isolation and culture for haploid induction in plant breeding. 9. Learn how to isolate and culture plant embryos for in vitro regeneration and propagation. 10. Acquire the ability to prepare synthetic seeds and recognize their role in plant propagation and conservation.

Mapping between Cos with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO 1-10								

Pre-requisite	Basic Biology

	1. To Study Key Components of a Plant Tissue Culture Lab. **2.** To prepare Murashige and Skoog (MS) Medium and learn its application in plant tissue culture. **3.** To inoculate different plant explants into MS medium and observe their growth. **4.** To prepare B5 medium and learn its application in plant tissue culture. **5.** To inoculate explants into B5 medium and observe their growth. **6.** To isolate protoplasts using Enzymatic Approach. **7.** To isolate protoplasts using Mechanical Approach. **8.** To isolate and culture anthers for haploid production in plant breeding. **9.** To isolate and culture plant embryos for regeneration. **10.** To prepare synthetic seeds for plant propagation and understand their applications.
Reference Books	• Bhojwani, S. S., & Razdan, M. K. (1986). *Plant tissue culture: theory and practice*. Elsevier. • Razdan, M. K. (2002). *An introduction to plant tissue culture*. Oxford and IBH publishing.
e-learning resources	• Kumar, R. (2016) 'Laboratory requirements in plant tissue culture', *Plant Biotechnology*, (January 2015), pp. 1–23. Available at: https://www.researchgate.net/publication/301564270_Laboratory_Requirements_in_Plant_Tissue_Culture. • Nongdam, P. (2016) 'Development of Synthetic Seed Technology in Plants and its Applications: A Review', *Int J Curr Sci*, 19(4), pp. 86–101.
Teaching Methodology	Laboratory work, Journal preparation
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

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-VI

Course: BT-MJ-603: Animal Biotechnology

Course Code	BT-MJ-603
Course Title	**Animal Biotechnology**
Credits	2
Course Level	300-399
Total engagement	2 Credits x 15 Hours = 30 Hours
Teaching per week	2h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation &holidays)
Effective from	2025-2026
Purpose of Course	The purpose of the course is to give knowledge to the students regarding the fundamentals of animal biotechnology.
Course Objectives	The objective is to explain students about aseptic techniques, basics of cultured cells and animal reproductive biology.
Course Outcomes	CO1: Students would be able to get details of equipments for cell culture, sterile handling and types of tissue culture. CO2: Students would get insights about biology of cultured cells, cell culture media and animal reproductive biology.
Mapping between Cos with PSOs	See table below
Pre-requisite	Biology, Cell biology
Course Content	See table below

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

UNIT-1: Introduction to Animal Biotechnology and Aseptic Techniques Introduction, Applications of animal biotechnology, Advantages and limitations of animal tissue culture, Equipment for cell culture, Types of tissue culture, Aseptic environment and sterile handling.	Teaching Hours:15
UNIT-2: Biology of Cultured Cells and Animal Reproductive Biology Cell adhesion, Cell proliferation, Cell differentiation, Physical properties of media, Complete media and Sterilization of media, *In vitro* fertilization, Artificial insemination, Embryo transfer technology	Teaching Hours:15

Reference Books	• Freshney, I. (2016). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications (8th ed.). Wiley-Blackwell • Gordon I, editor (2017). Reproductive technologies in farm animals 2nd ed. CABI • B. K. Sinha and Rinesh Kumar (2008). Principles of Animal Cell Culture, IBD Co., Lucknow • M. M. Ranga (2019). Animal Biotechnology (3rd Edition), Agrobios, India.
e-learning resources	SWAYAM (https://swayam. gov. in/)
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
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-2603001306033002]

BTP-MJ-603: Animal Biotechnology Practical

Course Code	BTP-MJ-603
Course Title	**Animal Biotechnology Practical**
Credits	2
Course Level	300-399
Total engagement	4 h x 15 weeks = 60 Hours
Teaching per week	4h
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The purpose of the course is to familiarize students with handling practical problems related to animal biotechnology.
Course Objectives	The objective is to perform practical based on animal cell culture.
Course Outcomes	CO1: To provide basic knowledge of buffers and its preparation. CO2: Preparation of cell culture media and to explain its importance in culture. CO3: Practical skills of students will be enhanced as they learn the sterilization of media for culturing animal cells CO4: Students will learn the isolation of cells from tissue. CO5: Students will gain insights about cell viability assay. CO6: To learn antioxidation activity by DPPH assay. CO7: Students will learn how to extract DNA from animal tissue.
Mapping between Cos with PSOs	
Pre-requisite	Basic Biology

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1 to 7								

Course Content	1. Preparation of buffers: PBS/HBSS 2. Preparation of media for animal cell culture: RPMI 1640/DMEM. 3. Sterilization of buffers and animal cell culture media. 4. Isolation of cells from spleen/Chick fibroblast. 5. Cell viability assay (Trypan blue). 6. DPPH radical scavenging assay. 7. DNA extraction from animal tissue.	Teaching Hours:60
Reference Books	• Freshney, I. (2016). Culture of Animal Cells: A Manual of Basic Technique and Specialized Applications (8th ed.). Wiley-Blackwell • Sudha Gangal (2007). Principles and Practice of Animal Tissue Culture, Universities Press, Hyderabad.	
e-learning resources	• https://videos.thermofisher.com/detail/video/5765965627001/cell-culture:-cell-culture-basics	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
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	

Semester-VI

Course Code	Course Title	Teaching Schedule Hours/Week	Exam Duration & Marks			Total Theory/Practical Marks	Credit
			Duration (Hours: Minutes)	(CCE) Internal Marks	(SEE) External Marks		
BT-ME-601	Pharmaceutical Biotechnology	2	1:00	25	25	50	2
BTP-ME-601	Pharmaceutical Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**
BT-ME-602	Environmental Biotechnology	2	1:00	25	25	50	2
BTP-ME-602	Environmental Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
	Total	**6**	**7:00**	**50**	**50**	**100**	**4**

[Subject Code-2603001306044001]

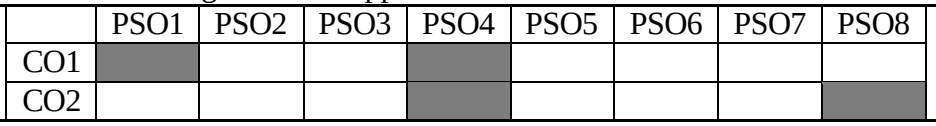
VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology (B. Sc.)

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

Semester-VI

Course: BT-ME-601: Pharmaceutical Biotechnology

Course Code	BT-ME-601
Course Title	**Pharmaceutical Biotechnology**
Course Level	200-399
Credit	02
Total engagement	02 Credits x 15 Hours = 30 Hours
Teaching per week	02
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The course is designed to provide knowledge regarding different drug delivery systems and therapeutic usage of RNA, Enzyme and Hormones (with specific example). The course will give ideation about the phases in drug discovery and development along with the regulatory authorities involved.
Course Objective	• To make students aware about different Drug Delivery systems and approaches for better delivery of biotechnology derived drugs. To get acquitted about different regulatory agencies involved in the process of drug approval and marketing • The discussion of drug designing and development will create awareness about preclinical and clinical procedures along with different pharmaceutical parameters like pharmacodynamics and pharmacokinetics that should be taken into consideration during the process.
Course Outcomes	CO1: The students will gain knowledge about contribution of biotechnological techniques in pharmaceutical product development and therapeutics. The students will have knowledge of different drug delivery systems. CO2: The students will get information regarding drug discovery and development process. The students will be aware of regulatory authorities involved in drug molecule approval.
Mapping between COs with PSOs	
Pre-requisite	Basic Knowledge of Biology And Biochemistry
Course Content	**UNIT 1: Biopharmaceuticals, Drug Delivery and Therapeutics:** Biopharmaceuticals: Current Status and future prospects, Drug delivery systems (Liposomes, Nasal spray, biodegradable polymer), Therapeutic — Teaching Hours: 10

	technology (RNAi and Antisense), Enzyme and Hormones in Therapy (Superoxide dismutase, DNAse and Insulin)	
	UNIT 2: Drug Discovery, Development and Regulatory Affairs: Phases of drug creation (Drug discovery process and Drug development, pre-clinical and clinical pharmacology), Pharmacodynamics, Pharmacokinetics, Investigational New Drug Application (IND), Regulatory agency: Food and Drug Administration (FDA), International Council for Harmonisation (ICH), Central Drugs Standard Control Organisation (CDSCO), Indian Pharmacopoeia Commission (IPC).	Teaching Hours: 20
Reference Books	• Walsh G. Pharmaceutical biotechnology: Concepts and applications. John Wiley and Sons; 2013 • Rang H P. Drug Discovery and Development. Technology in Transition. 2012 • Ho RJ, Gibaldi M. Biotechnology and Biopharmaceuticals. Transforming Proteins and Genes into Drugs.2003 • Jogdand SN. Medical Biotechnology. Himalaya Publishing House, 2008	
e-learning resources	• Novel Drug Delivery Systems: An Important Direction for Drug Innovation Research and Development - PMC https://pmc.ncbi.nlm.nih.gov/articles/PMC11124876/ • https://doi.org/10.1021/acs.chemmater.2c03003 • Pharmaceutical Biotechnology: Fundamentals and Applications | SpringerLink https://link.springer.com/book/10.1007/978-3-031-30023-3#toc	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.	

[Subject Code-2603001306044002]

BTP-ME-601: Pharmaceutical Biotechnology Practical

Course Code	BTP-ME-601
Course Title	**Pharmaceutical Biotechnology Practical**
Course Level	200-399
Credit	02
Total engagement	02 Credits x 30 Hours = 60 Hours
Teaching per week	04
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026

<table>
<tr><td>Purpose of Course</td><td>The create practical understanding regarding pharmaceutical products, their testing and production.</td></tr>
<tr><td>Course Objective</td><td>To extent the understanding about primary test, practical parameters, regulatory compliance test, laboratory scale production applicable in the field of Pharmaceutical Biotechnology.</td></tr>
<tr><td>Course Outcomes</td><td>• Student will be able to understand the parameters like the concept of sterility of the given pharmaceutical product which is prerequisite for safety of any marketed product.
• Plant extract can be a possible therapeutic molecule. Minimum inhibitory concentration (MIC) of plant extract against microbial growth will be studied. This estimated MIC can be used for further research on the crude plant extract.
• Create understanding for preparation of simple synthetic drug
• Assay for estimating purity of synthetic drug will help student to understand the testing of synthetic drug.
• This experiment that will create general awareness regarding components of daily hygiene products and nutraceuticals.
• Practical 6 to 8: The drug discovery and development process demands various tests to be fulfilled by the new drug molecule. The tests are in compliance to the various regulatory authorities. These experiments will develop ideation regarding test that are applicable on the drug molecule under regulatory authorities.</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>CO1 to 8</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>Basic Knowledge of Biology and Biochemistry</td></tr>
<tr><td>Course Content</td><td>1. Sterility testing of pharmaceutical products
2. Determine Minimum Inhibitory Concentration (MIC) of plant extract (leaf/flower/root/fruit) (Disc diffusion method)
3. To prepare simple synthetic drug molecule (Antiseptic- Iodine solution/ Laxative- Magnesium Hydroxide mixture/ Castor oil emulsion/ Astringent- Calamine lotion)
4. Assay of purity of synthetic drug (Chlorpheniramine Maleate/ Isoniazid/Chloroquine Phosphate/Dapsone)
5. Design and conduct a simple experiment for laboratory level production of daily hygiene products (toothpaste/ shampoo/ soap/detergent/ antiseptic lotion/ energy drink/immunity booster)
6. Demonstration regarding Dissolution test for pharmaceutical products (IPC standard)
7. Demonstration regarding Disintegration test for pharmaceutical products (IPC standard)
8. Demonstration regarding Preservative Efficacy test (PET) for cosmetics products (EU standard: ISO 11930:2019 and ISO 29621:2017)</td></tr>
<tr><td>Reference Books</td><td>• The Indian Pharmacopoeia Commission, Ministry of Health & Family Welfare Government of India, Indian Pharmacopoela 2010, Vol.1 Sixth Edition;
• Gupta A.K., Jain V.K., Pharmaceutics-I Practical Note Book, CBS Publishers & Distributors Pvt.Ltd.2020; 15
• Mehta R.M., Dispensing Pharmacy, Vallabh Prakashan, New Delhi, 2017; 150-151.
• Subrahmanyam C.V.S., Thimmasetty J.J, Prabhushankar G.L., Laboratory manual of Pharmaceutics. Vallabh Publication, Delhi, 2019; 47-48.
• R. J. Patel and K. R. Patel, Experimental Microbiology Volume-2, Aditya, Ahmedabad, Gujarat, India</td></tr>
</table>

e-learning resources	• chlorphenamine-hydrogen-maleate.pdf https://cdn.who.int/media/docs/defaultsource/medicines/pharmacopoeia/omitted-monographs/chlorphenamine-hydrogen-maleate.pdf?sfvrsn=5c45cbd2_5 • https://doi.org/10.1016/j.jpha.2011.09.002
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

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Semester-VI

Course: BT-ME-602: Environmental Biotechnology

Course Code	BT-ME-602
Course Title	**Environmental Biotechnology**
Course Level	200-399
Credit	02
Total engagement	02 Credits x 15 Hours = 30 Hours
Teaching per week	02
Minimum weeks per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The course "Environmental Biotechnology" aims to provide students with a comprehensive understanding of bioenergy, bioremediation, and waste management technologies. It focuses on sustainable energy production, environmental remediation techniques, and effective waste treatment processes to promote a cleaner and more sustainable environment.
Course Objective	The objective of "Environmental Biotechnology" course is to provide students with an understanding of bioenergy, bioremediation, and waste management technologies, focusing on sustainable solutions for energy production and environmental cleanup. It aims to equip students with the knowledge and skills to apply these technologies in addressing real-world environmental challenges.
Course Outcomes	CO1: Students will gain a comprehensive understanding of bioenergy sources and bioremediation technologies. They will be equipped to evaluate the potential of renewable bioenergy sources and apply bioremediation techniques for environmental clean-up. CO2: students will understand wastewater treatment methods and municipal waste management systems. Students will also gain insights into bioleaching, biopolymer production, and their real-world applications in sustainable environmental management.
Mapping between COs with PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Pre-requisite	Basic Knowledge of Biology And Biochemistry	
Course Content	**UNIT-I: BIOENERGY & BIOREMEDIATION** Biogas Technology, Bioethanol Production from Cellulosic Waste, Microbial Hydrogen Production, Biotransformation of Xenobiotics, Environmental Carcinogenicity Testing, Principles and Types of Bioremediations and Phytoremediation	Teaching Hours: 15

	UNIT-II: WASTE MANAGEMENT & SPECIAL PROCESSES Characteristics of Wastewater, Aerobic Biological Wastewater Treatment: Activated Sludge and Oxidation Ponds, Anaerobic Biological Wastewater Treatment: UASB and Anaerobic Baffled Reactor, Municipal Waste Management Rules, Bioleaching: Types and Methods, Biopolymers: Types, Preparation, Properties and Practical Applications	Teaching Hours: 15
Reference Books	• Fulekar MH, Environmental Biotechnology, CRC Press; 2010 Jul 19. • Thakur IS. Environmental Biotechnology. IK International, New Delhi. 2006. • Pepper IL, Gerba CP, Gentry TJ, Maier RM, editors. Environmental microbiology. Academic press; 2011 Oct 13.	
e-learning resources	• https://www.researchgate.net/publication/343967531_Bioremediation	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.	

[Subject Code-2603001306044004]

BTP-ME-602: Environmental Biotechnology Practical

Course Code	BTP-ME-602
Course Title	**Environmental Biotechnology Practical**
Credits	2
Course Level	300-399
Total Engagement	2 Credits x 30 Hours = 60 Hour
Teaching per week	4 hours
Minimum weeks Per semester	15 weeks (Including classwork, examination, preparation & holidays)
Effective from	2025-2026
Purpose of Course	The purpose of this course is to introduce students to the key concepts and methodologies used in environmental monitoring and pollution assessment. It aims to enhance their understanding of the impact of pollution on natural resources and provides practical experience in analyzing water and soil quality, as well as exploring real-world case studies of environmental disasters.
Course Objective	The objective of this course is to provide students with practical skills in environmental monitoring and analysis, focusing on water and soil quality assessment, as well as microbial isolation techniques. Students will gain hands-on experience in evaluating pollution levels and understanding the impact of industrial and environmental contamination through case studies and field visits.

<table>
<tr><td>Course Outcomes</td><td colspan="9">Upon completion of the Environmental Biotechnology Practical Course, students will:
Students will learn to measure the Biological Oxygen Demand (BOD) to assess the organic pollution in water.
Students will develop skills to determine the Chemical Oxygen Demand (COD) for evaluating the level of chemical pollutants in water.
Students will learn to measure the concentration of dissolved solids in wastewater, indicating water quality.
Students will gain experience in isolating microorganisms from contaminated soil for environmental analysis.
Students will learn techniques for isolating microorganisms from industrial wastewater to understand microbial contamination.
Students will perform coliform testing to assess the microbial quality of water.
Students will isolate bacteria from petroleum-contaminated soil.
Students will use pH strips/pH meter to evaluate the acidity or alkalinity of water and soil samples.
Students will analyze the environmental and human impact of the Bhopal Gas Tragedy through case study analysis.
Students will gain practical insights into wastewater treatment processes by visiting a treatment plant.</td></tr>
<tr><td rowspan="2">Mapping between COs with PSOs</td><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 to 10</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>Pre-requisite</td><td colspan="9">Basic Science</td></tr>
<tr><td></td><td colspan="9">1. Estimation of BOD in polluted water samples.
2. Estimation of COD in polluted water samples.
3. Estimation of Total Dissolved Solids (TDS) in waste water samples.
4. Isolation of microorganisms from Polluted soil.
5. Isolation of microorganisms from Industrial effluents.
6. Determination of quality of water sample (Coliform test).
7. Isolation of Bacteria from Crude Petroleum Oil Contaminated Soil.
8. Measurement of Water & Soil Quality Using pH Strips/pH Meter.
9. Case Study: Bhopal Gas Tragedy.
10. Visit to a Wastewater Treatment Plant.</td></tr>
<tr><td>Reference Books</td><td colspan="9">Fulekar MH, Environmental biotechnology, CRC Press; 2010 Jul 19.
Thakur IS. Environmental Biotechnology. IK International, New Delhi. 2006.</td></tr>
</table>

e-learning resources	• https://www.sciencedirect.com/topics/engineering/total-dissolvedsolid#:~:text=Water%20and%20effluents&text=TDS%20is%20usually%20given%20as,%CE%BCho'%20or%20'%CE%BCS'. • https://www.researchgate.net/publication/343601060_Case_study_for_Bhopal_Gas_Tragedy
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment Laboratory work, Journal preparation
Evaluation Method	50% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 50% External based on semester end University examination.

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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.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

-: પરિપત્ર :-

યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૫–૨૬ થી અમલમાં આવનાર T.Y.B.Sc. English Sem.-5 & 6 નો AEC અને SEC નો પેટાસમિતિ દ્વારા તૈયાર કરવામાં આવેલ અભ્યાસક્રમ અંગ્રેજી વિષયની અભ્યાસ સમિતિના ચેરમેનશ્રીએ અભ્યાસ સમિતિ વતી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ સ્વીકારી વિજ્ઞાન વિદ્યાશાખાની તા.૩૦/૦૪/૨૦૨૫ની સભાનાં ઠરાવ ક્રમાંકઃ૨૬ થી કરેલ ભલામણ સ્વીકારી એકેડેમિક કાઉન્સિલની તા.૦૫/૦૫/૨૦૨૫ ની સભાનાં ઠરાવ ક્રમાંકઃ ૯૩ થી મંજુર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

બિડાણઃ ઉપર મુજબ

ક્રમાંકઃઓથો./પરિપત્ર/સિલેબસ/૧૧૯૯૮/૨૦૨૫
તા.૨૬–૦૫–૨૦૨૫

કુલસચિવ

પ્રતિ,
૧) યુનિવર્સિટી સંલગ્ન વિજ્ઞાન વિદ્યાશાખા હેઠળની તમામ કોલેજોનાં આચાર્યશ્રીઓ.
.....આપશ્રીની કોલેજના સંબંધિત શિક્ષકોને જાણ કરી અમલ કરવા સારૂ.
૨) ડીનશ્રી, વિજ્ઞાન વિદ્યાશાખા.
૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.
.....તરફ જાણ તેમજ અમલ સારૂ.

VEER NARMAD SOUTH GUJARAT UNIVERSITY

NEP – 2020 GUIDED

SYLLABUS FOR ABILITY ENHANCEMENT COURSE
(AEC)

ENGLISH PROFICIENCY AND LIFE SKILLS- V

FOR B.A/ B.COM. /B.SC./B.SC. COMP. SC. (REGULAR)
SEMESTER VI

FOR THE ACADEMIC YEARS 2025-26 TO 2027-28

Dr. G .K.Nanda

[Subject Code - 2603000506050001]

B.A./ B.COM. /B.SC. /B.Sc. Comp.Sc. SEM 6 : TEXT : ***Aspirations* :*English for Careers*(OB)**

<table>
<tr><td>Course Code</td><td></td></tr>
<tr><td>Course Title</td><td>ENGLISH PROFICIENCY AND LIFE SKILLS - V</td></tr>
<tr><td>Credit</td><td>2</td></tr>
<tr><td>Teaching per Week</td><td>2 hours</td></tr>
<tr><td>Minimum weeks per Semester</td><td>15 (including class work, examination, preparation, holidays etc.)</td></tr>
<tr><td>Effective From</td><td>June 2025</td></tr>
<tr><td>Purpose of Course</td><td>To prepare the young graduates for the job market today by boosting their linguistic competency and professional skills .</td></tr>
<tr><td>Course Objectives</td><td>To equip the students with the necessary language skills for effective communication and success in the global professional environment, enabling them to navigate international business, access information, and advance their career.</td></tr>
<tr><td>Course Outcomes</td><td>After completing the course the students will be able to :

CO1: enhance communication skills.

CO2: go for career advancement through job opportunities and higher earning potential.

CO3: achieve professional development through professional networking and improved professional image.</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></tr><tr><td>CO1</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></tr><tr><td>CO3</td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>Pre-requisite</td><td>Acquaintance with basic grammar and language skills</td></tr>
</table>

Course Content	**TEXTBOOK:** ***Aspirations*** **:*English for Careers*(OB)** **Unit 1 Exploring Careers** • Creative Writing • Translation • Journalism • English for Academia and other careers • English in the Tourism Industry • English for Science & technology **Unit 2 A. Basic preparation for Jobs** • Writing job application/Cover letter • Writing Resumes • Group Discussions • Personal Interviews **B. English for the Corporate Field** • English for sales & customer services • Telephonic sales & customer services • Digital Sales & customer services • Presentation Skills
Reference Books	1. Anderson, Linda. *Creative Writing: A Workbook with Readings*. Taylor and Francis ,2014 2. Bell, Julia, ed. *The Creative Writing Coursebook*.Macmillan,2001. 3. Cole, John G. '*7 Careers for Translation Students*'. Keystone Bachelor studies.27 Sep.2019. 4. Basturkmen , Helen .*Ideas and Options in English for specific purposes*. Routledge ,2005. 5. Hutchinson, T. and A . Francisco. *English for Specific Purposes: A Learning -centered Approach.* CUP 6. Kaul, Asha. Business Communication. Prentice Hall of India ,2002. 7. Hindle ,T.M. *Making Presentations*. Dorling Kindersley(DK),2013 8. Skills You Need. Presentation Skills .2021 https://www.skillsyouneed.com/presentation-skill.html

Teaching Methodology	Class work, Discussion, Self-Study, Assignment, Homework, Activity , Self- Assessment etc.
Evaluation Method	This course has 02 credits during the semester. The internal evaluation will be out of 25 marks, based on Unit Testmarks, class and home assignments and attendance marks; while the external evaluation will be out of 25 marks at the university examination.

Distribution of Marks for the University Examination as per NEP SOP

Q 1. MCQs from Unit 1 only (10/10) **10 Marks**

Q 2. A Group Discussion or Interview from Unit 2 A (1/ 2) **05 Marks**

B**.** Resume Writing from Unit 2 A (1/2) **05 Marks**

C. Letter / Telephonic Conversation from Unit 2 A **05 Marks**

OR

Presentation through Powerpoint slides on a given topic (at least 5 slides required) from Unit 2 B

_____

Total 25 Marks

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યુનિવર્સિટી કેમ્પસ, ઉધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.
Tel : +91 - 261 - 2227141 to 2227146, Toll Free : 1800 2333 011, Digital Helpline No.- 0261 2388888
E-mail : info@vnsgu.ac.in, Website : www.vnsgu.ac.in

ક્રમાંકઃઓથો./પરિપત્ર/૧૩૬૪૦/૨૦૨૬
તા.૧૯/૦૬/૨૦૨૬

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

વિષયઃ– B.Sc. Biotechnology Sem.- 7 & 8 Honours (with OJT/without OJT) અને Honours with Research ના અભ્યાસક્રમ બાબત.

સુજ્ઞશ્રી,

સવિનય જણાવવાનું કે, NEP-2020 અંતર્ગત શૈક્ષણિક વર્ષ ૨૦૨૬–૨૭ થી અમલમાં આવનાર B.Sc. Biotechnology Sem.- 7 & 8 Honours (with OJT / without OJT) અને Honours with Research નો પેટાસમિતિ દ્વારા તૈયાર કરેલ અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૨/૦૪/૨૦૨૬ ની સભાના ઠરાવ ક્રમાંકઃ૦૨ થી મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાની તા.૦૪/૦૬/૨૦૨૬ની સભાના ઠરાવ ક્રમાંકઃ૧૪થી મંજૂર કરવા એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૧૮/૦૬/૨૦૨૬ની સભાના ઠરાવ ક્રમાંકઃ૧૨ થી મંજૂર કરેલ છે. જેનો અમલ કરવા આથી જાણ કરવામાં આવે છે.

(બિડાણઃ ઉપર મુજબ)

કુલસચિવ વતી

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

Undergraduate Program

In

Biotechnology

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

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Undergraduate Program in Biotechnology

Major & Minor with Research/OJT

Teaching & Evaluation Scheme: Semester-VII

[Academic Year of Implementation 2026-2027]

Semester-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-MJ-701	Genomics and Proteomics	2	1:00	25	25	50	2
BTP-MJ-701	Genomics and Proteomics: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-702	Industrial Fermentation Technology	2	1:00	25	25	50	2
BTP-MJ-702	Industrial Fermentation Technology: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-703	GMP, Quality Control & Validation	2	1:00	25	25	50	2
BTP-MJ-703	GMP, Quality Control & Validation: Practical	4	4:00 to 6:00	25	25	50	2
BT-ME-701	Sustainable Development Goals in Biotechnology	2	1:00	25	25	50	2
BTP-ME-701	Sustainable Development Goals in Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
OR							
ME	Fundamentals of Cyber Security	4	4:00	50	50	100	4
BT-RP-01	Research Project / On-the-Job Training (OJT)	12		75	75	150	6
Total		**36/34**	**--**	**275**	**275**	**550**	**22**

[Subject code-2603000507011111]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-701
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-701
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-702
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-702
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability
Subject Type	Discipline Specific Course
Course Code	BT-MJ-703
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-703
Course Level	400-499
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	

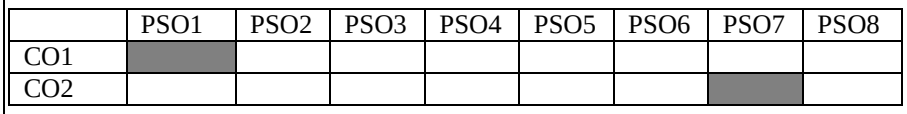
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability
Subject Type	Intra-disciplinary
Course Code	BT-ME-701
Course Level	400-499
Course Title	Sustainable Development Goals in Biotechnology
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Understand the Principles, Concept, Scope & Importance of sustainable and green biotechnology with Developmental Goals (SDGs). **CO2:** To get Knowledge regarding Bioremediation, Bio fertilizers, Biofuels , Bio-pesticides and Ethical, Regulatory, and Biosafety issues.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content	**UNIT – 1: Foundations of Sustainable and Green Biotechnology** Concept, scope, and importance of sustainable and green biotechnology, United Nations Sustainable Development Goals (SDGs): overview and relevance to biotechnology and their role in achieving SDGs (2, 3, 6, 7, 12, 13, 15), Principles of green biotechnology and its applications.	Teaching Hours: 15
	UNIT – 2: Applications of Sustainable Biotechnology Concept and applications of: Bioremediation, Biofertilizers, Biofuels and Biopesticides, Biotechnology for clean water and sanitation, sustainable biomaterials and their applications, Ethical, Regulatory, and Biosafety issues.	Teaching Hours: 15

Reference Books	• Abha Kumari (2025), Sustainable Technologies for Value Addition to Biomass Waste. Elsevier, ISNB: 978-0-443-36318-4 • R. K. Salar (2013), Biotechnology: Prospects & Applications, Springer, eISBN: 978-81-322-1683-4 • Alan H. Scragg (2005), Environmental Biotechnology, Oxford University Press, ISBN-13: 9780199268672 • OECD, Biotechnology for Sustainable Development • Christoph Wittmann & James C. Liao (2017), Industrial Biotechnology, Wiley, ISBN-978-3-527-34179-5
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability
Subject Type	Intra-disciplinary
Course Code	BTP-ME-701
Course Level	400-499
Course Title	Sustainable Development Goals in Biotechnology: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: To characterize microbial biofertilizers, analyze vermicompost & energy consumption and evaluate the effectiveness of biofertilizers.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

Course Content	1. Production and characterization of microbial bio-fertilizers (Azotobacter/Rhizobium) 2. Preparation and analysis of compost. 3. Seed germination and growth promotion assay using biofertilizers. 4. To Analyze Energy consumption of the given Area. 5. Case study-based practical on sustainability.	Teaching Hours: 60
Reference Books	• Abhakumari (2025), Sustainable Technologies for Value Addition to Biomass Waste. Elsevier, ISNB: 978-0-443-36318-4 • R. K. Salar (2013), Biotechnology: Prospects & Applications, Springer, eISBN: 978-81-322-1683-4 • Alan H. Scragg (2005), Environmental Biotechnology, Oxford University Press, ISBN-13: 9780199268672 • OECD, Biotechnology for Sustainable Development • Christoph Wittmann & James C. Liao (2017), Industrial Biotechnology, Wiley, ISBN-978-3-527-34179-5	
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
Undergraduate Program in Biotechnology

Major & Minor with Research/OJT

Teaching & Evaluation Scheme: Semester-VIII

[Academic Year of Implementation 2026-2027]

Semester-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-MJ-801	Advanced Molecular Techniques	2	1:00	25	25	50	2
BTP-MJ-801	Advanced Molecular Techniques: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-802	Bioinformatics and Data Sciences	2	1:00	25	25	50	2
BTP-MJ-802	Bioinformatics and Data Sciences: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-803	Entrepreneurship in Life Science	2	1:00	25	25	50	2
BTP-MJ-803	Entrepreneurship in Life Science: Practical	4	4:00 to 6:00	25	25	50	2
BT-ME-801	Nanotechnology	2	1:00	25	25	50	2
BTP-ME-801	Nanotechnology: Practical	4	4:00 to 6:00	25	25	50	2
OR							
ME	Entrepreneurship	4	4:00	50	50	100	4
BT-RP-02	Research Project / On-the-Job Training (OJT)	12		75	75	150	6
Total		**36/34**	**--**	**275**	**275**	**550**	**22**

[Subject code-2703000508011111**]**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BT-MJ-801
Course Level	400-499
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

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

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-2703000508011112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6.0
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BTP-MJ-801
Course Level	400-499
Course Title	Advanced Molecular Techniques: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	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 COs and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

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	Teaching Hours: 60

	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)	
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

[Subject code-2703000508021111]

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-802
Course Level	400-499
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 **[Subject code-2703000508021112]**

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-802
Course Level	400-499
Course Title	Bioinformatics and Data Science: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	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	<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. 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.

[Subject code-2703000508031111]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BT-MJ-803
Course Level	400-499
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-2703000508031112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BTP-MJ-803
Course Level	400-499
Course Title	Entrepreneurship in Life Sciences: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	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.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BT-ME-801
Course Level	400-499
Course Title	Nanotechnology
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	**CO1:** Students will learn about the nanostructure that are actively take part in the bodily functions. The property of self-assembly and hierarchical arrangement will be discussed. This will help them to understand the concept behind the structural and functional requirement of nano-assembly for efficient working. **CO2:** The application of nanomaterial as drug delivery and biosensors will be discussed. The students will be introduced to the recent filed of protein nanotechnology. The unit will cover the aspect related to the possible toxicological effect of nanomaterials.

Mapping between Cos and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content

UNIT – 1: Introduction to Nanobiotechnology Biotechnology and Nanotechnology: Introduction and Notable Prospects; Introduction to cellular Nanostructures: Nanopores and Biomolocular motors; Structural aspects of biomolecules as bio-nanomachinery (DNA and Protein assembly); Forces responsible for structural stability of biomoleclues (covalent, hydrogen bonds, electrostatic, hydrophobic); Hierarchical self-assembled nano-structures, self-organisation (Lipid bilayer membrane); Enzyme flexibility as challenge in structural design of nanoparticles.	Teaching Hours: 15
UNIT – 2: Applications of Nanotechnology and Assessment of Toxicity of Nanomaterials Nanomaterials for drug delivery system; Importance of protein nanotechnology; Construction of ordered protein array; Nanosystems for biosensing, Nano-Biosensors; Optical nanosensors, Impact of nanomaterials on Microbial system	Teaching Hours: 15

	Nanotoxicity testing, factors affecting nanotoxicity (chemical and physical). Introduction to Safety of nanomaterials, Basics of nanotoxicity, Models and assays for Nanotoxicity assessment; Mechanism of Nanosize particle toxicity-Passage through biological membranes-toxicokinetics Fate of nanomaterials in different stratas of environment that affect the human population; Regulations and permissible limits.	
Reference Books	• Goodshell, David S. Biotechnology: Lessons from Nature. John Wiley & sons, 2004 • Sharon Madhuri et al Bio-nanotechnology, Ane Books Pvt. Ltd., 2014 • Kulkarni, Sulabha K. Nanobiotechnology: Principles and Practices. Springer, 2014 • Tuan Vo-Dinh. Protein Nanotechnology: Protocols, Instrumentations and Applications. Humana press.2005. • Huang X., Yufang Zhu Y., Kianfar E. (2021), Nano Biosensors: Properties, applications and electrochemical techniques, Journal of Materials Research and Technology, 2, pp 1649-1672. (https://doi.org/10.1016/j.jmrt.2021.03.048)	
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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BTP-ME-801
Course Level	400-499
Course Title	Nanotechnology: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	Student will understand the concept of DLS scanning and zetapotential which is closely related to particle size analysis of nanomaterial. Student will be able to synthesis nanoparticles using different methods. One of the possible application of nanoparticles is to use it as antimicrobial agent. This practical course will give student hands on experience to test antimicrobial activity of prepared nanoparticles and will create awareness regarding computer-aided tools that can be used for designing the nanoparticles.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

Course Content	1. Demonstration of measurement of nanoparticles using dynamic light scattering (DLS). 2. Demonstration of Zeta potential and its effect on nanoparticle size. 3. Preparation of nanoparticles using plant extract 4. Sol-gel synthesis of nanoparticles 5. Antimicrobial activity of nanoparticles (Disc diffusion method) 6. Demonstration of Computer-aided Design tools for Nanoparticles.	Teaching Hours: 60
Reference Books	• McNeil, S.E., (2011) Characterization of Nanoparticles Intended for Drug Delivery", Humana press • Gérrard Eddy Jai Poinern, A Laboratory Course in Nanoscience and Nanotechnology, CRC Press Taylor & Francis Group, LLC, 2015. • R. J. Patel and K. R. Patel, Experimental Microbiology Volume-2, Aditya, Ahmedabad, Gujarat, India • Khac, K.T., Phu, H.H., Thi, H.T., Thuy, V.D., Thi, H.D. (2023) Biosynthesis of silver nanoparticles using tea leaf extract (*Camellia sinensis*) for photocatalyst and antibacterial effect, Heliyon 9 e20707 (https://doi.org/10.1016/j.heliyon.2023.e20707).	

	• Sathiyabama, M., Boomija, R. V., Muthukumar, S., Gandhi, M., Salma, S., Kokila Prinsha, T., Rengasamy B. (2024) Green synthesis of chitosan nanoparticles using tea extract and its antimicrobial activity against economically important phytopathogens of rice, Scientific Reports 14 pp 7381 (https://doi.org/10.1038/s41598-024-58066-y) • Raja, K., Mary Jaculine, M., Jose, M., Sunil Verma, Prince, A.A.M., Ilangovan, K., Sethusankar, K., Jerome Das S. (2015) Sol–gel synthesis and characterization of α-Fe2O3 nanoparticles. Superlattices and Microstructures 86 pp 306-312 (http://dx.doi.org/10.1016/j.spmi.2015.07.044) • NanoMaterials CAD software (https://nanocad.com/products/nanocad-free/)
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

Undergraduate Program in Biotechnology

Major & Minor without Research/OJT

Teaching & Evaluation Scheme Semester-VII

[Academic Year of Implementation 2026-2027]

Semester-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-MJ-701	Genomics and Proteomics	2	1:00	25	25	50	2
BTP-MJ-701	Genomics and Proteomics: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-702	Industrial Fermentation Technology	2	1:00	25	25	50	2
BTP-MJ-702	Industrial Fermentation Technology: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-703	GMP, Quality Control & Validation	2	1:00	25	25	50	2
BTP-MJ-703	GMP, Quality Control & Validation: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-704	Entrepreneurship in Rural Economy	4	2	50	50	100	4
			OR				
BT-MJ-705	IPR, Bioethics and Biosafety	4	2	50	50	100	4
BT-ME-701	Sustainable Development Goals in Biotechnology	2	1:00	25	25	50	2
BTP-ME-701	Sustainable Development Goals in Biotechnology: Practical	4	4:00 to 6:00	25	25	50	2
			OR				
ME	Fundamentals of Cyber Security	4	4:00	50	50	100	4
MJ-UGRM0107	Research Methodology-I	2	1:00	25	25	50	2
Total		**28**	**---**	**275**	**275**	**550**	**22**

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-701
Course Level	400-499
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.

[Subject code-2603000507011112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **SYLLABUS**	
Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-701
Course Level	400-499
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	6. To study Partial Restriction Digestion for Restriction Mapping. 7. To study the extraction of DNA from Yeast (*Saccharomyces cerevisiae*) 8. To study the isolation of total proteins from plants. 9. To study the gel preparation for SDS-PAGE. 10. 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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-702
Course Level	400-499
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.

[Subject code-2603000507021112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT **SYLLABUS**	
Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-702
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability
Subject Type	Discipline Specific Course
Course Code	BT-MJ-703
Course Level	400-499
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.	

[Subject code-2603000507031112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-703
Course Level	400-499
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	6. Prepare a Report on Standard Operating Procedures (SOPs) for any Pharmaceutical/Biotechnology/Food product. 7. Case study of GMP outline of any reputed company. 8. Equipment Calibration and Report Documentation at your institute level 9. Labelling, Storage and Traceability according to QC Guidelines. 10. 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	B.Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Intra-disciplinary
Course Code	BT-MJ-704
Course Level	400-499
Course Title	Entrepreneurship in Rural Economy
Credit	4
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Explain and evaluate rural entrepreneurship concepts, cow-based enterprise models, and relevant government support schemes for sustainable rural development. **CO2:** Apply biotechnology techniques to develop value-added products (Jeevamrut, Panchgavya, vermicompost, biogas) and design a basic sustainable rural enterprise plan with financial and scheme linkage components. **CO3:** Describe the scientific basis and applications of bio-based rural technologies such as Jeevamrut, Panchgavya, vermicomposting, and biogas in sustainable agriculture. **CO4:** Develop and evaluate basic rural enterprise strategies involving value addition, market linkage, and financial feasibility for bio-based and dairy-related enterprises.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

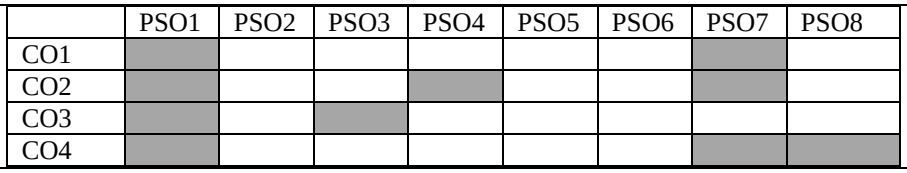
Course Content	**UNIT – 1: Rural Entrepreneurship Fundamentals** Types of rural enterprises (agriculture, processing, services). Role of cow-based economy including A2 vs A1 milk and utilization of dung and urine. Opportunities and challenges in rural enterprises with reference to Gujarat. Socio-economic importance and contribution to SDGs.	Teaching Hours: 15

	UNIT – 2: Rural Entrepreneurship Ecosystem Institutional support: NABARD, KVIC, MUDRA, SVEP, and related schemes. Role of SHGs and women entrepreneurship. Support systems including finance, training, and capacity building. Case studies of successful rural enterprises such as dairy cooperatives.	Teaching Hours: 15
	UNIT – 3: Bio-based Rural Technologies Concepts of Jeevamrut and Panchgavya in agriculture. Principles of vermicomposting and biogas production. Waste-to-resource conversion and role of bio-inputs in sustainable rural development	Teaching Hours: 15
	UNIT – 4: Rural Enterprise Development and Value Addition Value addition of cow-based products and rural resources. Basics of enterprise development including idea generation, cost considerations, and market linkage. Marketing strategies such as branding and packaging. Analysis of rural enterprises from economic and sustainability perspectives.	Teaching Hours: 15
Reference Books	• Khanka, S.S. (2014). Entrepreneurship Development. New Delhi: S. Chand Publishing. • Desai, V. (2011). Dynamics of Entrepreneurial Development and Management. Mumbai: Himalaya Publishing House. • Charantimath, P.M. (2018). Entrepreneurship Development and Small Business Enterprises. New Delhi: Pearson Education. • De, S. (2005). Outlines of Dairy Technology. New Delhi: Oxford University Press. • Prasad, R. (2012). Principles of Dairy Farming. New Delhi: Kalyani Publishers. • Purohit, S.S. (2016). Organic Farming: Principles and Practices. Jodhpur: Agrobios (India). • Pathak, R.K. (2017). Handbook of Organic Farming. New Delhi: ICAR Publications. • Subba Rao, N.S. (2017). *Biofertilizers in Agriculture and Forestry*. New Delhi: Oxford & IBH Publishing. **Government Reports & Manuals** • National Bank for Agriculture and Rural Development (NABARD). Annual Reports and Rural Entrepreneurship Scheme Guidelines. • Khadi and Village Industries Commission (KVIC). Village Industries Development Manuals. • Ministry of Micro Small and Medium Enterprises (MSME). Government of India Scheme Documents. • National Centre of Organic Farming. Biofertilizer and Organic Input Preparation Manuals. • Ministry of Rural Development, Government of India. *Start-Up Village Entrepreneurship Programme (SVEP) Guidelines*. **E-Resources** • https://onlinecourses.swayam2.ac.in/e-learning/preview/ini24_hs07 (SWAYAM Course-Tribal Entrepreneurship & Economy) • https://www.intechopen.com/chapters/79567 **Research/Review papers** • https://pmc.ncbi.nlm.nih.gov/articles/PMC8814384/ • https://pubmed.ncbi.nlm.nih.gov/34998645/	

	• https://pubmed.ncbi.nlm.nih.gov/28413254/ • https://pubmed.ncbi.nlm.nih.gov/34026314/ • https://pubmed.ncbi.nlm.nih.gov/39524546/ • https://pubmed.ncbi.nlm.nih.gov/40609196/ • https://www.mdpi.com/2079-9276/14/7/102
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

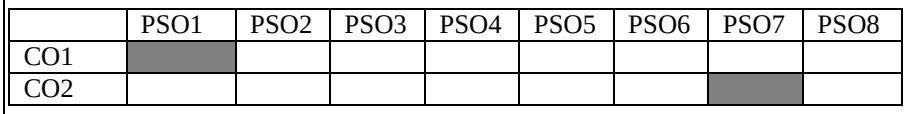
SYLLABUS

Program Name	B.Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability
Subject Type	NIL
Course Code	BT-MJ-705
Course Level	400-499
Course Title	IPR, Bioethics and Biosafety
Credit	4
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** The learner will be able to apply bioethical principles and frameworks to evaluate ethical issues in biotechnology, including regulatory roles of national and international bioethics bodies and ethical implications of biological weapons. **CO2:** To apply biosafety regulations and risk assessment principles to select appropriate containment levels (BL-1 to BL-4) and ensure safe handling, spill management, and biological waste disposal. **CO3:** To understand IPR and patent law frameworks, including patenting of living organisms, the Indian Patent Act and its amendments, USA and European patent systems, and WIPO/TRIPS provisions with post-TRIPS changes in India. **CO4:** To apply patenting procedures to biological products, manage IPR commercialization (licenses, royalties), understand plant variety protection under UPOV and Indian law, and analyze landmark IPR cases.
Mapping between Cos and PSOs	
Course Content	**UNIT – 1: Fundamentals of Bioethics** Bioethics & its Origin; Principles; Different approaches to Ethics; Past, Present & Future Bioethical conflicts in Biotechnology; Bioethics Advisory Committee-IBC of UNESCO, ICMR Ethics guidelines-General principles, General Ethical issues, Informed consent process; Biological weapons & their implications.
	Teaching Hours: 15

	UNIT – 2: Biosafety & Biosecurity Overview of Biosafety; Cartagena Protocol on Biosafety; Indian Biosafety Framework; Risk Assessment-Risk group & Biosafety levels, Process of Risk assessment; Containment & its methods; Different containment levels- BL-1, BL-2, BL-3, BL-4; Biological spillage, Precautions, Managing Biological waste & Treatment.	Teaching Hours: 15
	UNIT – 3: Fundamentals of IPR Introduction & types of IPR; Patenting of living organism-Brief history; Indian Patent Act 1970 & its Amendment; Patent law in other countries- USA & Europe; International Conventions & Treaties- WIPO, TRIPS Agreement-features, principles, major changes in Indian Patent system post-TRIPS.	Teaching Hours: 15
	UNIT – 4: Patenting in Biotechnology Basic requirement of Patent; Patent Application; Patenting Biological products; Selling an invention, licenses & royalties; UPOV Convention 1961 & Functions; Plant variety Protection & Farmer's Right Act-plant variety, need & objective for protection, registration, Farmer's Rights; Case studies in IPR- Diamond vs Chakraborty case (1980), Neem Patent Case.	Teaching Hours: 15
Reference Books	• Brauer, D. (1995). Biotechnology: Legal, economic and ethical dimensions (Vol. 12). Weinheim, Germany: VCH Publishers • Goel, D., & Parashar, S. (2013). IPR, biosafety and bioethics. New Delhi, India: Pearson Education India. • Gupta, P. K. (2010). Elements of biotechnology (2nd ed.). Meerut, India: Rastogi Publications. • ICMR. (2018). Handbook on national ethical guidelines for biomedical and health research involving human participants. New Delhi, 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.	

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability
Subject Type	Intra-disciplinary
Course Code	BT-ME-701
Course Level	400-499
Course Title	Sustainable Development Goals in Biotechnology
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Understand the Principles, Concept, Scope & Importance of sustainable and green biotechnology with Developmental Goals (SDGs). **CO2:** To get Knowledge regarding Bioremediation, Bio fertilizers, Biofuels , Bio-pesticides and Ethical, Regulatory, and Biosafety issues.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content	**UNIT – 1: Foundations of Sustainable and Green Biotechnology** Concept, scope, and importance of sustainable and green biotechnology, United Nations Sustainable Development Goals (SDGs): overview and relevance to biotechnology and their role in achieving SDGs (2, 3, 6, 7, 12, 13, 15), Principles of green biotechnology and its applications.	Teaching Hours: 15
	UNIT – 2: Applications of Sustainable Biotechnology Concept and applications of: Bioremediation, Biofertilizers, Biofuels and Biopesticides, Biotechnology for clean water and sanitation, sustainable biomaterials and their applications, Ethical, Regulatory, and Biosafety issues.	Teaching Hours: 15

Reference Books	• Abha Kumari (2025), Sustainable Technologies for Value Addition to Biomass Waste. Elsevier, ISNB: 978-0-443-36318-4 • R. K. Salar (2013), Biotechnology: Prospects & Applications, Springer, eISBN: 978-81-322-1683-4 • Alan H. Scragg (2005), Environmental Biotechnology, Oxford University Press, ISBN-13: 9780199268672 • OECD, Biotechnology for Sustainable Development

	• Christoph Wittmann & James C. Liao (2017), Industrial Biotechnology, Wiley, ISBN-978-3-527-34179-5
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	B. Sc. Biotechnology Honors
Semester	VII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability
Subject Type	Intra-disciplinary
Course Code	BTP-ME-701
Course Level	400-499
Course Title	Sustainable Development Goals in Biotechnology: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	CO: To characterize microbial biofertilizers, analyze vermicompost & energy consumption and evaluate the effectiveness of biofertilizers.
Mapping between Cos and PSOs	

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO								

Course Content	6. Production and characterization of microbial bio-fertilizers (Azotobacter/Rhizobium) 7. Preparation and analysis of compost. 8. Seed germination and growth promotion assay using biofertilizers. 9. To Analyze Energy consumption of the given Area. 10. Case study-based practical on sustainability.	Teaching Hours: 60
Reference Books	• Abhakumari (2025), Sustainable Technologies for Value Addition to Biomass Waste. Elsevier, ISNB: 978-0-443-36318-4 • R. K. Salar (2013), Biotechnology: Prospects & Applications, Springer, eISBN: 978-81-322-1683-4 • Alan H. Scragg (2005), Environmental Biotechnology, Oxford University Press, ISBN-13: 9780199268672 • OECD, Biotechnology for Sustainable Development • Christoph Wittmann & James C. Liao (2017), Industrial Biotechnology, Wiley, ISBN-978-3-527-34179-5	
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
Undergraduate Program in Biotechnology

Major & Minor without Research/OJT

Teaching & Evaluation Scheme Semester-VIII

[Academic Year of Implementation 2026-2027]

Semester-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-MJ-801	Advanced Molecular Techniques	2	1:00	25	25	50	2
BTP-MJ-801	Advanced Molecular Techniques: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-802	Bioinformatics and Data Science	2	1:00	25	25	50	2
BTP-MJ-802	Bioinformatics and Data Science: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-803	Entrepreneurship in Life Science	2	1:00	25	25	50	2
BTP-MJ-803	Entrepreneurship in Life Science: Practical	4	4:00 to 6:00	25	25	50	2
BT-MJ-804	Synthetic Biology	4	2:00	50	50	100	4
BT-ME-801	Nanotechnology	2	1:00	25	25	50	2
BTP-ME-801	Nanotechnology: Practical	4	4:00 to 6:00	25	25	50	2
			OR				
ME	Entrepreneurship	4	4:00	50	50	100	4
MJ-UGRM02028	Research Methodology-II	2	1:00	25	25	50	2
Total		**28**	**---**	**275**	**275**	**550**	**22**

[Subject code-2703000508011111]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honours
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BT-MJ-801
Course Level	400-499
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

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

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

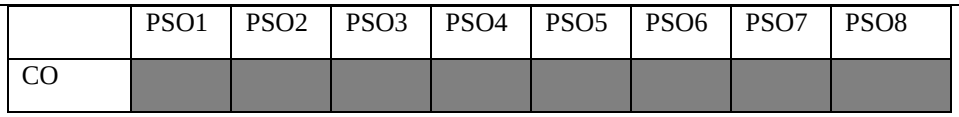
	UNIT – 2: Advanced Techniques in Nucleic Acid & PCR Isothermal amplification: basic concepts and application of LAMP. Nucleic acid hybridization: principles and uses of Southern and Northern blotting. Primer design: Basic principles of primer design for nucleic acid amplification. DNA–protein interaction 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-2703000508011112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honours
Semester	VIII
NCrF Credit Level	6.0
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BTP-MJ-801
Course Level	400-499
Course Title	Advanced Molecular Techniques: Practical
Credit	2
Effective From	Academic Year: 2026-2027
Course Outcomes	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 COs and PSOs	
Course Content	7. Immunological Assays and Flow Cytometry Data Analysis (ELISA – indirect/sandwich and virtual flow cytometry interpretation) 8. Primer Design, *In Silico* PCR Validation, and Advanced Design Strategies 9. PCR Optimization and Gradient PCR Analysis 10. Bioinformatics Analysis of Protein Structure, Localization, and Function 11. Rational Antigen Design and Epitope Prediction 12. 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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BT-MJ-802
Course Level	400-499
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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific Course
Course Code	BTP-MJ-802
Course Level	400-499
Course Title	Bioinformatics and Data Science: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	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	<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	7. Introduction to bioinformatics tools and databases & retrieval of nucleotide and protein sequences from NCBI 8. Use of UniProt for protein information analysis 9. Pairwise sequence alignment using online tools 10. BLAST analysis for sequence similarity search 11. Multiple sequence alignment using Clustal Omega 12. 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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BT-MJ-803
Course Level	400-499
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

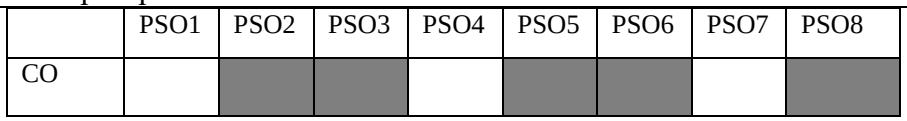
- Shimasaki, C. (2014) Biotechnology Entrepreneurship: Starting, Managing, and Leading Biotech Companies. Academic Press, USA.
- Drucker, P. F. (2014) Innovation and Entrepreneurship. Harper Business.

	• 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-2703000508031112]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Entrepreneurship
Subject Type	Discipline Specific / Intra-disciplinary
Course Code	BTP-MJ-803
Course Level	400-499
Course Title	Entrepreneurship in Life Sciences: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	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	
Course Content	9. Business Model Canvas Preparation 10. Market Survey & Feasibility Study 11. Entrepreneur Interview & Report Writing 12. Cost Estimation & Break-even Calculation Exercise 13. TRL Identification Exercise 14. Preparation of Mini Start-up Concept Note 15. Pitch Presentation 16. 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-2703000508051111]

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

SYLLABUS

Program Name	B.Sc. Biotechnology Honors
Semester	Sem.-VIII
NCrF Credit Level	6
Course Type	Major
Course Subtype	Nil
Subject Type	Discipline Specific
Course Code	BT-MJ-804
Course Level	400-499
Course Title	Synthetic Biology
Credit	4
Effective From	Academic Year: 2026-2027
Course Outcomes	**CO1:** Explain the fundamental concepts, historical development, and interdisciplinary foundations of synthetic biology, and differentiate it from systems biology. **CO2:** Apply molecular, genome editing, and computational tools of synthetic biology to design, model, and construct genetic circuits, metabolic pathways, and synthetic systems. **CO3:** Analyse diverse applications of synthetic biology in healthcare, bio-manufacturing, metabolic engineering, bio-sensing, and microbiome engineering. **CO4:** Evaluate current research areas, emerging technologies, and future challenges in synthetic biology, including genome-level engineering, xenobiology, and industrial translation
Mapping between Cos and PSOs	See table below
Course Content	**UNIT – 1: Fundamental Concepts in Synthetic Biology** Definition and historical development of synthetic biology, Synthetic Biology versus Systems Biology, Synthesis and Engineering Tools: DNA Synthesis, Protein Engineering, Pathway Engineering, Genome Engineering, Computational and Theoretical Tools: Genomics, Proteomics and Metabolomics Tools, Challenges and Future Perspectives.
	Teaching Hours: 15

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								
CO3								
CO4								

	UNIT – 2: Tools used in Synthetic Biology DNA manipulation techniques: PCR, cloning, and gene synthesis, Introduction to genome editing techniques: CRISPR-Cas9, Standard biological parts and devices, Modularity and abstraction in genetic engineering, and Computational, tools for designing genetic circuits, Cell signaling and communication, Metabolic engineering and pathway design, Synthetic microbial communities	Teaching Hours: 15
	UNIT – 3: Applications of Synthetic Biology Gene therapies, Metabolic engineering – products, Bio-production of chemicals, fuels, and pharmaceuticals; Biosensors and bio-actuators Microbiome engineering: Therapeutic strains & Probiotics, Leveraging intracellular architecture. Scaling-up and bio-manufacturing.	Teaching Hours: 15
	UNIT – 4: Areas of Research and Current Scenario of Synthetic Biology DNA-based circuits, Synthetic metabolic pathway engineering and Genome-level engineering, Protocell construction, Xenobiology, Products for synthetic biology, along with their Products.	Teaching Hours: 15
Reference Books	• Secretariat of the Convention on Biological Diversity (2015). Synthetic biology, Montreal, Technical Series No. 82, 118 pages. • Huimin Zhao (Ed.), Synthetic Biology: Tools and Applications, Academic Press, Elsevier, 2013. • Jing Liang, Yunzi Luo, and Huimin Zhao, Synthetic biology: putting synthesis into biology, Wiley Interdiscip Rev Syst Biol Med, 3,7-20,2011. • Biotechnology Industry Organization (BIO). 2013. Current Uses of Synthetic Biology for Renewable Chemicals, Pharmaceuticals, and Biofuels. Available at: http://www.bio.org/sites/default/files/SyntheticBiology-and-Everyday-Products-2012.pdf, accessed on 7 March 2013.	
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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BT-ME-801
Course Level	400-499
Course Title	Nanotechnology
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	**CO1:** Students will learn about the nanostructure that are actively take part in the bodily functions. The property of self-assembly and hierarchical arrangement will be discussed. This will help them to understand the concept behind the structural and functional requirement of nano-assembly for efficient working. **CO2:** The application of nanomaterial as drug delivery and biosensors will be discussed. The students will be introduced to the recent filed of protein nanotechnology. The unit will cover the aspect related to the possible toxicological effect of nanomaterials.

Mapping between Cos and PSOs

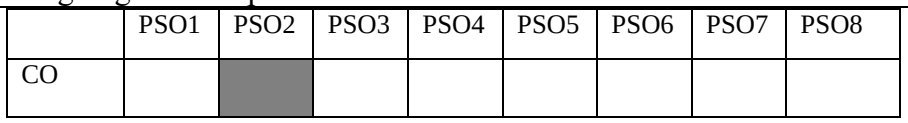
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
CO1								
CO2								

Course Content	**UNIT – 1: Introduction to Nanobiotechnology** Biotechnology and Nanotechnology: Introduction and Notable Prospects; Introduction to cellular Nanostructures: Nanopores and Biomolocular motors; Structural aspects of biomolecules as bio-nanomachinery (DNA and Protein assembly); Forces responsible for structural stability of biomoleclues (covalent, hydrogen bonds, electrostatic, hydrophobic); Hierarchical self-assembled nano-structures, self-organisation (Lipid bilayer membrane); Enzyme flexibility as challenge in structural design of nanoparticles.	Teaching Hours: 15

	UNIT – 2: Applications of Nanotechnology and Assessment of Toxicity of Nanomaterials Nanomaterials for drug delivery system; Importance of protein nanotechnology; Construction of ordered protein array; Nanosystems for biosensing, Nano-Biosensors; Optical nanosensors, Impact of nanomaterials on Microbial system Nanotoxicity testing, factors affecting nanotoxicity (chemical and physical). Introduction to Safety of nanomaterials, Basics of nanotoxicity, Models and assays for Nanotoxicity assessment; Mechanism of Nanosize particle toxicity-Passage through biological membranes-toxicokinetics Fate of nanomaterials in different stratas of environment that affect the human population; Regulations and permissible limits.	Teaching Hours: 15
Reference Books	• Goodshell, David S. Biotechnology: Lessons from Nature. John Wiley & sons, 2004 • Sharon Madhuri et al Bio-nanotechnology, Ane Books Pvt. Ltd., 2014 • Kulkarni, Sulabha K. Nanobiotechnology: Principles and Practices. Springer, 2014 • Tuan Vo-Dinh. Protein Nanotechnology: Protocols, Instrumentations and Applications. Humana press.2005. • Huang X., Yufang Zhu Y., Kianfar E. (2021), Nano Biosensors: Properties, applications and electrochemical techniques, Journal of Materials Research and Technology, 2, pp 1649-1672. (https://doi.org/10.1016/j.jmrt.2021.03.048)	
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	B. Sc. Biotechnology Honors
Semester	VIII
NCrF Credit Level	6
Course Type	Minor
Course Subtype	Employability and Skill Development
Subject Type	Discipline Specific
Course Code	BTP-ME-801
Course Level	400-499
Course Title	Nanotechnology: Practical
Credit	2
Effective From	Academic Year: 2026-27
Course Outcomes	Student will understand the concept of DLS scanning and zetapotential which is closely related to particle size analysis of nanomaterial. Student will be able to synthesis nanoparticles using different methods. One of the possible application of nanoparticles is to use it as antimicrobial agent. This practical course will give student hands on experience to test antimicrobial activity of prepared nanoparticles and will create awareness regarding computer-aided tools that can be used for designing the nanoparticles.
Mapping between Cos and PSOs	
Course Content	7. Demonstration of measurement of nanoparticles using dynamic light scattering (DLS). 8. Demonstration of Zeta potential and its effect on nanoparticle size. 9. Preparation of nanoparticles using plant extract 10. Sol-gel synthesis of nanoparticles 11. Antimicrobial activity of nanoparticles (Disc diffusion method) 12. Demonstration of Computer-aided Design tools for Nanoparticles. Teaching Hours: 60
Reference Books	• McNeil, S.E., (2011) Characterization of Nanoparticles Intended for Drug Delivery", Humana press • Gérrard Eddy Jai Poinern, A Laboratory Course in Nanoscience and Nanotechnology, CRC Press Taylor & Francis Group, LLC, 2015. • R. J. Patel and K. R. Patel, Experimental Microbiology Volume-2, Aditya, Ahmedabad, Gujarat, India

	• Khac, K.T., Phu, H.H., Thi, H.T., Thuy, V.D., Thi, H.D. (2023) Biosynthesis of silver nanoparticles using tea leaf extract (*Camellia sinensis*) for photocatalyst and antibacterial effect, Heliyon 9 e20707 (https://doi.org/10.1016/j.heliyon.2023.e20707). • Sathiyabama, M., Boomija, R. V., Muthukumar, S., Gandhi, M., Salma, S., Kokila Prinsha, T., Rengasamy B. (2024) Green synthesis of chitosan nanoparticles using tea extract and its antimicrobial activity against economically important phytopathogens of rice, Scientific Reports 14 pp 7381 (https://doi.org/10.1038/s41598-024-58066-y) • Raja, K., Mary Jaculine, M., Jose, M., Sunil Verma, Prince, A.A.M., Ilangovan, K., Sethusankar, K., Jerome Das S. (2015) Sol–gel synthesis and characterization of α-Fe2O3 nanoparticles. Superlattices and Microstructures 86 pp 306-312 (http://dx.doi.org/10.1016/j.spmi.2015.07.044) • NanoMaterials CAD software (https://nanocad.com/products/nanocad-free/)
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.