



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, ઉદ્ધના-મગદલ્લા રોડ, સુરત - ૩૯૫ ૦૦૭, ગુજરાત, ભારત.

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ક્રમાંક :એસ./પરિપત્ર/૧૨૭૯૮/૨૦૨૪

તા.૧૯/૦૬/૨૦૨૪

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

વિષય:- S.Y.B.Sc. Sem.- 3 & 4 બાયોટેકનોલોજી વિષયના અભ્યાસક્રમ બાબત.

સુજાશ્રી,

સવિનય જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી અમલમાં આવનાર S.Y.B.Sc. Sem.- 3 & 4 બાયોટેકનોલોજી વિષયનો Major, Minor, MDC અને SEC નો અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસસમિતિની તા.૦૩/૦૬/૨૦૨૪ ની સભાના ઠરાવ ક્રમાંક:૦૨અન્વયે નીચે મુજબ કરેલ ભલામણને વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલની તા.૧૫/૦૬/૨૦૨૪ની સભાના ઠરાવ ક્રમાંક:૯૬ થી સ્વીકારી મંજૂર કરેલ છે, જેની આથી જાણ કરવામાં આવે છે.

બાયોટેકનોલોજીવિષયની અભ્યાસ સમિતિની તા.૦૩/૦૬/૨૦૨૪ ની સભાના ઠરાવ ક્રમાંક:૦૨

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી અમલમાં આવનાર પેટાસમિતિ દ્વારા તૈયાર કરેલ S.Y.B.Sc. Sem.- 3 & 4 Biotechnology વિષયનો Major, Minor, MDC અને SECનો અભ્યાસક્રમ સર્વાનુમતે મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

એકેડેમિક કાઉન્સિલની તા.૧૫/૦૬/૨૦૨૪ની સભાના ઠરાવ ક્રમાંક: ૯૬

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૪-૨૫ થી અમલમાં આવનાર S.Y. B.Sc. Sem.- 3 & 4 બાયોટેકનોલોજી વિષયનો Major, Minor, MDC અને SECનો અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની અભ્યાસ સમિતિની તા.૦૩/૦૬/૨૦૨૪ ની સભાના ઠરાવ ક્રમાંક:૦૨ અન્વયે કરેલ ભલામણને વિજ્ઞાન વિદ્યાશાખાના અધ્યક્ષશ્રીએ વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

(બિડાણ: ઉપર મુજબ)

nifesa
કુલસચિવ

પ્રતિ,

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

.....જાણ સારું.

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એકેડેમિક કાઉન્સિલ નં. 15-06 -2024
બાબત..... ૧.૬..... બિડાણ/પરિશિષ્ટ..... 14..... 1

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT



Undergraduate Program

In

Biotechnology

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

Program Outcome (PO):

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

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

Undergraduate Program in Biotechnology as per NEP 2020 [3 years (Degree) & 4 years (Honours/Honours with Research)]

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	1	25	25	50	2
BTP-MJ-301	Basics of Phytophysiology: Practical	4	4	25	25	50	2
BT-MJ-302	Fundamentals of Genetics	2	1	25	25	50	2
BTP-MJ-302	Fundamentals of Genetics: Practical	4	4	25	25	50	2
BT-MJ-303	Applications of Statistical Methods in Biology-I	4	2	50	50	100	4
Total				150	150	300	12

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	1	25	25	50	2
BTP-MJ-401	Fundamentals of Immunology: Practical	4	4	25	25	50	2
BT-MJ-402	Basics of Molecular Biology	2	1	25	25	50	2
BTP-MJ-402	Basics of Molecular Biology: Practical	4	4	25	25	50	2
BT-MJ-403	Applications of Statistical Methods in Biology-II	4	2	50	50	100	4
Total				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	<ul style="list-style-type: none"> -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	<p>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.</p> <p>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.</p>								
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. Donnan equilibrium including sodium potassium pump.
Reference Books	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> (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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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

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

	<p>leaf.</p> <p>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.</p> <p>CO3: Students will acquire the practical knowledge of osmotic potential of plant.</p> <p>CO4: Students to draw conclusions, and discuss the four-leaf method to determine the loss of water.</p> <p>CO5: Students will compare the C3 and C4 plants anatomical studies.</p> <p>CO6: The students will be able to study how carbon dioxide affect the photosynthesis process.</p> <p>CO7: This experiment allows students to explore the impact of Micro and macronutrients on plants and their deficiency.</p> <p>CO8: Students will demonstrate the Arc auxanometer and its function in measurement of plant growth.</p> <p>CO9: Students will study the assembly of Wilmott's bubbler and its role in determination of photosynthetic ability of plants.</p> <p>CO10: Students will be able to characterize plant hormones.</p>																		
Mapping between COs with PSOs	<table border="1"> <thead> <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> </thead> <tbody> <tr> <td>CO 1-10</td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> </tbody> </table>		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	CO 1-10								
	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8											
CO 1-10																			
Pre-requisite	Basics of Biology																		
Course Content	<ol style="list-style-type: none"> To find out stomatal frequency and transpiration index of leaf. To separate the leaf pigments by paper chromatography technique and to estimate chlorophyll content of given plant leaf sample. Determination of Osmotic potential of cell sap by plasmolytic method. To compare the loss of water from two surfaces of leaf by Four leaf method. Comparatively anatomical studies of C3 and C4 plants. Effect of carbon dioxide concentration on the rate of photosynthesis. To study the effect of macro and micro nutrients on plant. To measure the rate of plant growth using Arc Auxanometer. To determine the rate of photosynthesis by using Wilmott's bubbler. Estimation of plant hormone by spectrophotometric method. 																		
Reference Books	<ul style="list-style-type: none"> Pandey, B. P. (1999). <i>Modern Practical Botany-Volume II</i>. S. Chand Publishing. Jain, V. K. (2018). <i>Fundamentals of Plant Physiology</i>. 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) 																		
Teaching Methodology	Laboratory work, Journal preparation																		
Evaluation Method	50% CCE (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative																		

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

Course Code	BT-MJ-302								
Course Title	Fundamentals of Genetics								
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	The purpose of the course is to give knowledge to the students regarding the fundamentals of genetics.								
Course Objective	The objective is to explain students about inheritance pattern of characters from one generation to another.								
Course Outcomes	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.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
Pre-requisite	Biology								
Course Content	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.								Teaching Hours: 15
	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								Teaching Hours: 15
Reference Books	<ul style="list-style-type: none"> D. Peter Snustad and Michael J. Simmons: Principles of Genetics, Wiley: John Wiley & Sons, Inc ISBN- 978-0-471-72597-8 								

	<ul style="list-style-type: none"> A. F. Griffiths, S. R. Wessler, R. C. Lewontin and S. B. Carroll (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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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

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: Apply knowledge of Mendelian inheritance patterns using model organism <i>Drosophila</i> . CO2: Examine and identify different stages of the cell cycle. CO3: Prepare and analyse slides to observe various stages of cell division. CO4: Conduct pedigree analysis to understand inheritance patterns.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO 1-10								
Pre-requisite	Basics of Biology and Biochemistry								
Course Content	<ol style="list-style-type: none"> Contribution of scientists in the field of genetics. Identification of Eye colour in <i>Drosophila</i>. Study of permanent slides of different stages of mitosis. Study of permanent slides of different stages of meiosis. To study meiosis by smear preparation of anthers. Study of different chromosomal banding techniques. 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 <i>Drosophila</i> salivary glands/ <i>Chironomous</i> Larvae.
Reference Books	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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 <ul style="list-style-type: none"> 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	

	<p>UNIT-2: Measures of Central Tendency and Dispersion</p> <ul style="list-style-type: none"> • 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
	<p>UNIT-3: Skewness, Kurtosis and Vital Statistics</p> <ul style="list-style-type: none"> • Skewness (Positive and Negative), Measures of Skewness (Karl Pearson, Bowley's and Kelly's Coefficient of Skewness and Moment based measure) Kurtosis (Mesokurtic, Leptokurtic, Platykurtic), Measure of kurtosis based on Moments. • Definition and Application of Vital Statistics, Measure of Fertility, Reproduction Rate and Mortality. 	Teaching Hours: 15
	<p>UNIT-4: Probability</p> <ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative	

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

Course Code	BT-MJ-401								
Course Title	Fundamentals of Immunology								
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	The purpose of the course is to give knowledge to the students regarding the Fundamentals of Immunology.								
Course Objective	To provide knowledge on essential features of Non-specific and Specific Host Resistance.								
Course Outcomes	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.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
Pre-requisite	Biology, Microbiology								
Course Content	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.								Teaching Hours: 15
	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.								Teaching Hours: 15
Reference Books	<ul style="list-style-type: none"> • Willey, J.M., Sherwood, L. M., & Woolverton, C. J., (2008). <i>Prescott, Harley & Klein's Microbiology</i>, 7th 								

	<p>Edition, The McGraw-Hill Companies, Inc.</p> <ul style="list-style-type: none"> • Kuby Janis, (2007). <i>Immunology</i>, 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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

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	<p>CO1: Determine the blood group of a given blood sample using the slide agglutination technique.</p> <p>CO2: Conduct blood cross matching tests using the tube method.</p> <p>CO3: Accurately count cells using a Haemocytometer.</p> <p>CO4: Determine the differential leukocyte count of a given blood sample.</p> <p>CO5: Perform single radial immunodiffusion using Mancini's technique.</p> <p>CO6: Execute an enzyme-linked immunosorbent assay (ELISA) or Dot ELISA.</p> <p>CO7: Detect malaria antigens using commercially available kits.</p> <p>CO8: Conduct a Widal test for the diagnosis of typhoid.</p> <p>CO9: Diagnose syphilis using the Rapid Plasma Reagin (RPR) test.</p> <p>CO10: Understand the principles and steps involved in Western Blotting through demonstration.</p>

Mapping between COs with PSOs	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO 1-10							
Pre-requisite	Basics of Biology, Biochemistry, Microbiology							
Course Content	<ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative							

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

Course Code	BT-MJ-402								
Course Title	Basics of Molecular Biology								
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	The purpose of the course is to provide students with fundamental knowledge and understanding of the principles, concepts, and techniques used in molecular biology.								
Course Objective	Students will gain insight into the molecular mechanisms underlying biological processes.								
Course Outcomes	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.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
Pre-requisite	Biology								
Course Content	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.							Teaching Hours: 15	
	UNIT-2: Transcription, Translation and Post Transcriptional and Translational Modifications.							Teaching Hours: 15	

Reference Books	<ul style="list-style-type: none"> • Watson J. <i>et al.</i> ((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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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

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

Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology
Course Content	<ol style="list-style-type: none"> 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	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative

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, Marshall-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	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative	

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	1	25	25	50	2
BTP-ME-401	Introduction to Food and Dairy Technology: Practical	4	4	25	25	50	2
Total		6	5	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	<ul style="list-style-type: none"> • 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative	

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

		preparedness for professional roles within the industry.							
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
		CO 1-10							
Pre-requisite	Biology, Chemistry, Basic Microbiology								
Course Content	<ol style="list-style-type: none"> 1. To learn the method of preparation of Dahi/Yoghurt using different types of milk and Organoleptic evaluation of prepared product. 2. Preparation of Rennet Casein. 3. Sensory Evaluation of Milk. 4. Chemical Tests for Milk Quality: COB, Alcohol Test 5. Quality Analysis of milk by MBRT. 6. Determination of chemical constituents of Food 7. Microbial Analysis of Packed Food: Ice cream or Cold Drink 8. Microbial Analysis of Fruit or Vegetable sample 9. Production of any Probiotic drink/Product and microbial analysis of LAB. 10. Visit to Dairy/Food Industry. 								
Reference Books	<ul style="list-style-type: none"> • Frazier, W. C., & Westhoff, D. C. (1988). Food Microbiology. McGraw-Hill. • Modi, H. A. (2009). Dairy Microbiology, Aavishkar Publishers, Jaipur. 								
e-learning resources	<ul style="list-style-type: none"> • 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/) 								
Teaching Methodology	Laboratory work, Journal preparation								
Evaluation Method	50% CCE (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative								

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	2	50	50	100	4
Total		4	2	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	<p>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.</p> <p>CO2: Students will study about properties of light, lenses, the structure of the eye, refractive errors, and polarization principles.</p> <p>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.</p> <p>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.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
Pre-requisite	Biology; Physics; Chemistry								

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	<ul style="list-style-type: none"> • P. K. Srivastava (2011) <i>Elementary Biophysics</i>, Narosa Publishing House, ISBN: 978-81-7319-913-4 • G. R. Chatwal (2020) <i>Biophysics</i>, Himalaya Publishing House, ISBN: 978-93-5024-583-5 • Arrondo, J. L. R., & Alonso, A (2007) <i>Advanced techniques in biophysics</i> (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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative	

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	1	13	12	25	1
BTP-SEC-301	Seed Technology: Practical	2	2	12	13	25	1
Total		3	3	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	1	13	12	25	1
BTP-SEC-401	Isolation and Enumeration of Microbes: Practical	2	2	12	13	25	1
Total		3	3	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: <ol style="list-style-type: none"> 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: 1. Study Structure of gram and bean seeds. 2. Study effect of light conditions on seed germination. 3. Study effect of temperature and water on seed germination. 4. Study effect of different pH conditions on seed germination. 5. Study seed dormancy (Demonstration).							Teaching Hours: 30
Reference Books	<ul style="list-style-type: none"> • Pandey, S. N., & Sinha, B. K. (2009). <i>Plant physiology</i>. Vikas Publishing House. • Verma, S. K., & Verma, M. (2008). <i>A textbook of plant physiology, biochemistry and biotechnology</i>. S. Chand Publishing. • Pandey, B. P. (1999). <i>Modern Practical Botany-Volume II</i>. 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 (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative							

VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT
Undergraduate Program (Science Faculty)
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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	<ul style="list-style-type: none"> - 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		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
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. 1. Isolation of microbes using selective and differential media. 2. Isolation and cultivation of anaerobic bacteria using thioglycolate medium.							Teaching Hours: 30	

	<ol style="list-style-type: none"> 3. Enumeration of microbial population using standard plate count method. 4. Enumeration of yeast using haemocytometer. 5. MPN for coliforms. 	
Reference Books	<ul style="list-style-type: none"> • Anderson, D., Salm, S., Allen, D., & Nester, E. (2016). <i>Nester's Microbiology- A Human Perspective</i> (8th ed.). McGraw Hill Education. • Aneja, K. (2014). <i>Laboratory Manual of Microbiology and Biotechnology</i> (1st ed.). MedTech. • Joanne Willey, L. S. (2017). <i>Prescott's Microbiology</i> (10 ed.). McGraw Hill. • Patel, R., & Patel, K. (2022). <i>Lecture notes on Introduction to Microbiology</i>. Aditya Publication. • Patel, R., & Patel, K P. (2016) <i>Experimental Microbiology</i> (9 ed., Vol. I). Aditya Publication. 	
e-learning resources	https://www.youtube.com/dbtvnsngu	
Teaching Methodology	Classwork, Discussion, Self-Study, Projects, Seminars and/or Assignment	
Evaluation Method	50% CCE (Continuous and Comprehensive Evaluation)-Formative & 50% SEE (Semester End Evaluation)-Summative	