



Re-Accredited by NAAC with 'A' Grade

**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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## **-: પરિપત્ર :-**

વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન બાયોટેકનોલોજી વિષય ચલાવતી અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓને તથા ડિપાર્ટમેન્ટના વડાશ્રીને જણાવવાનું કે, શૈક્ષણિક વર્ષ ૨૦૨૨-૨૩ થી અમલમાં આવનાર બાયોટેકનોલોજી વિષયનાં સેમ.-૭ ના અભ્યાસક્રમ અંગે બાયોટેકનોલોજી વિષયની નિયુક્ત એડહોક અભ્યાસ સમિતિની તા.૨૪/૦૬/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંક:૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખા વતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ એકેડેમિક કાઉન્સિલએ તેની તા.૦૫/૦૭/૨૦૨૨ ની સભાના ઠરાવ ક્રમાંક:૧૦ અન્વયે સ્વીકારી મંજૂર કરેલ છે. તેની જાણ સંબંધકર્તા શિક્ષકો અને વિદ્યાર્થીઓને કરવી, તદ્દઉપરાંત તેનો અમલ કરવો.

**બી.એસસી.એન્ડ એમ.એસસી. બાયોટેકનોલોજી વિષયની નિયુક્ત (એડહોક) સમિતિની તા.૨૪/૦૬/૨૦૨૨ની સભાનાં ઠરાવ ક્રમાંક:૨**

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨-૨૩ થી અમલમાં આવનાર 5 year Integrated Program બાયોટેકનોલોજી વિષયનાં સેમ.-૭ ના અભ્યાસક્રમ મંજૂર કરી વિજ્ઞાન વિદ્યાશાખાને ભલામણ કરવામાં આવે છે.

**એકેડેમિક કાઉન્સિલની તા.૦૫/૦૭/૨૦૨૨ ની સભાનાં ઠરાવ ક્રમાંક: ૧૦**

:: આથી ઠરાવવામાં આવે છે કે, શૈક્ષણિક વર્ષ ૨૦૨૨-૨૩ થી અમલમાં આવનાર બાયોટેકનોલોજી વિષયનાં સેમ.-૭ ના અભ્યાસક્રમ બાયોટેકનોલોજી વિષયની નિયુક્ત એડહોક અભ્યાસ સમિતિની તા.૨૪/૦૬/૨૦૨૨ ની સભાનાં ઠરાવ ક્રમાંક:૨ અન્વયે કરેલ ભલામણ વિજ્ઞાન વિદ્યાશાખાનાં અધ્યક્ષશ્રીએ વિજ્ઞાન વિદ્યાશાખાની મંજૂરીની અપેક્ષાએ વિજ્ઞાન વિદ્યાશાખાવતી મંજૂર કરી એકેડેમિક કાઉન્સિલને કરેલ ભલામણ સ્વીકારી મંજૂર કરવામાં આવે છે.

બિડાણ: ઉપર મુજબ

ક્રમાંક : એસ/પરિપત્ર/સિલેબસ/૧૪૪૦૮/૨૦૨૨

તા. ૦૭-૦૭-૨૦૨૨

  
ઈ.ચા. કુલસચિવ

પ્રતિ,

- ૧) વિજ્ઞાન વિદ્યાશાખા હેઠળની સંલગ્ન બાયોટેકનોલોજી વિષય ચલાવતી અનુસ્નાતક કોલેજોનાં આચાર્યશ્રીઓ તથા ડિપાર્ટમેન્ટનાં વડાશ્રી.
- ૨) અધ્યક્ષશ્રી, વિજ્ઞાન વિદ્યાશાખા.
- ૩) પરીક્ષા નિયામકશ્રી, પરીક્ષા વિભાગ, વીર નર્મદ દ. ગુ. યુનિવર્સિટી, સુરત.

.....તરફ જાણ તેમજ અમલ સારૂ.

## VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT

Item No. 10

Encl. 9

## M. Sc. Integrated Biotechnology

[Academic Year of Implementation: 2022-2023]

Teaching and Examination Scheme for Semester-VII

Course Code	Paper	Teaching Schedule Hours/Week	Exam Schedule			Total Theory/Practical (Marks)	Credits
			Duration (Hours)	Internal Marks	External Marks		
	<b>Theory papers:</b>						
BT-101	<b>Core Paper I:</b> Advances in Cell Biology	4	3	30	70	100	4
BT-102	<b>Core Paper II:</b> Plant and Animal Biotechnology	4	3	30	70	100	4
BT-103	<b>Core Paper III:</b> Enzyme Biotechnology	4	3	30	70	100	4
BT-104	<b>Elective Paper-I</b> Environmental Biotechnology	4	3	30	70	100	4
BT-104	<b>Elective Paper-II</b> Advances in Nanobiotechnology						
	<b>Practical:</b>						
BT-105	<b>Practical</b> based on 101 to 104	12	4 h X 3 days = 12 h	50	100	150	6
BT-106	<b>Skill based elective paper:</b> Techniques for Genetic Testing /SWAYAM/ MOOC courses	2	2	20	30	50	2
	<b>Total</b>			190	410	600	24

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-101: Advances in Cell Biology**

Course Code	BT-101								
Course Title	<b>Advances in Cell Biology</b>								
Credit	4								
Teaching per week	4 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	The purpose of this course is to make students aware with cell structure and functions and give them insights of vascular trafficking and cancer biology								
Course Objective	The objective of this is course are to sensitize the students to the fact that as we go down the scale of magnitude from cells to organelles to molecules, the understanding of various biological processes becomes deeper and inclusive.								
Course Outcomes	<p>CO1: To give basic knowledge of cell structure and functions to students. It also enlightens student about advanced types of microscopic techniques.</p> <p>CO2: This will give the knowledge of cellular signalling pathways and signal transduction pathways which are very helpful to understand the cellular processes</p> <p>CO3: It will explain student about different phases of cell cycles and their regulation which will help them to understand the differentiation of cells to students</p> <p>CO4: This will give students complete knowledge of cancer regarding it occurrence, oncogenes, tumour suppressor genes, its mechanism.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basic of Biology, Biotechnology, Biochemistry, Microbiology								
Course Content	<p><b>Unit-1: Cell structure and trafficking:</b>  Visualizing, Fractionating and culturing cells, Bio-membrane structure, Transmembrane Transport of ions and small molecules  Cellular Energetics, Moving Proteins in to membranes and organelles, Vascular Traffic, Secretion, Endocytosis and Synthetic Cell.</p> <p><b>Unit-2: Cell Signalling</b>  Signalling Molecules and their Receptors, Function of cell surface Receptors, Pathways of Intracellular Signal Transduction, signal transduction and the cytoskeleton, Signalling Networks.</p>								

	<p><b>Unit-3: Cell Cycle</b> The Eukaryotic Cell Cycle, Regulators of Cell Cycle Progression, The Events of M Phase, Meiosis and fertilization, Apoptosis,</p> <p><b>Unit-4: Cancer Biology</b> The development and causes of cancer, Tumour Viruses, Oncogenes, Tumour Suppressor genes, Molecular Approaches to Cancer Treatment</p>
Reference Books	<ul style="list-style-type: none"> <li>• Lodish, H. F. (2016). Molecular Cell Biology (8th Ed.). New York: W.H. Freeman. sixth Edition</li> <li>• Cooper, G. M., &amp; Hausman, R. E. (2013). The Cell: a Molecular Approach (6th Ed.). Washington: ASM; Sunderland. Fourth Edition</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-102: Plant and Animal Biotechnology**

Course Code	BT-102								
Course Title	<b>Plant and Animal Biotechnology</b>								
Credit	4								
Teaching per week	4 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	Students should be able to gain fundamental knowledge in animal and plant biotechnology and their applications.								
Course Objective	The objectives of this course are to introduce students to the principles, practices and application of animal biotechnology, plant tissue culture, plant and animal genomics, genetic transformation and molecular breeding of plants and animals.								
Course Outcomes	CO1: To develop competence in the areas of Plant tissue and animal cell culture. CO2: To Understand the processes and protocols related to plant genetic manipulation CO3: To have a comprehensive understanding of animal tissue culture, Stem cell research, transgenic techniques and biotechnological applications. CO4: To understand the concepts of Plant and animal genomics								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basic of Biology, Biotechnology, Biochemistry, Microbiology								
Course Content	<p><b>Unit-1 Plant tissue culture and animal cell culture</b>  Introduction to plant tissue culture; nutrient medium; sterilization techniques; types of culture; micropropagation; cell suspension and secondary metabolites; haploid production; protoplast isolation and fusion; cybrids; somaclonal variations. Animal cell culture: brief history of animal cell culture; culture of mammalian cells, tissues and organs; primary culture, criteria for subculture, subculture of cells growing in suspension and in monolayer; Cell separation techniques, Cryopreservation and cell viability.</p> <p><b>Unit-2 Plant genetic manipulation</b>  Gene transfer in plants: Agrobacterium-plant interaction; virulence; Ti and Ri plasmids; opines and their significance; T-DNA transfer; disarmed Ti plasmid; Genetic transformation - Agrobacterium-mediated gene delivery; direct gene transfer - PEG-mediated, electroporation, particle bombardment and alternative methods;</p>								

	<p>Screenable and selectable markers; status and expression of transferred genes; chloroplast transformation; molecular pharming - concept of plants as bioreactors, edible vaccines; medicinally related proteins-antibodies (Plantibodies); the oleosin system-hirudin and insulin production.</p> <p><b>Unit-3 Transgenic animals, Stem Cells &amp; Regenerative Medicine</b></p> <p>Transgenic manipulation of animal embryos; applications of transgenic animal technology; animal cloning - basic concept, cloning for conservation of endangered species; Stem cells and its application: Source and isolation of stem cells, Embryonic and adult stem cells, culture and maintenance of stem cells. Stem cells and therapeutics. Novel sources of multipotent stem cells.</p> <p><b>Unit-4 Plant and animal genomics</b></p> <p>Molecular markers - hybridization and PCR based markers RFLP, RAPD, STS, SSR, AFLP, SNP markers; DNA fingerprinting-principles and applications; introduction to mapping of genes/QTLs; marker-assisted selection - strategies for introducing genes of biotic and abiotic stress resistance in plants; molecular diagnostics of pathogens in plants and animals.</p>
Reference Books	<ul style="list-style-type: none"> <li>• Pörtner, R. (2007). Animal Cell Biotechnology: Methods and Protocols. Totowa, NJ: Humana Press.</li> <li>• Ian R. Freshney, Culture of animal cells: a manual of basic technique and specialized applications, 6<sup>th</sup> Ed., Willey Blackwell Publications.</li> <li>• Animal Cell Culture- Practical Approach. John, R.W. Masters. 2000. 3rd Edition. Oxford University Press.</li> <li>• Animal Cells Culture and Media, D. C. Darling and S. J. Morgan, 1994. BIOS Scientific Publishers Limited.</li> <li>• Animal Biotechnology, M. M. Ranga, 2000. Agrobios, India.</li> <li>• Chawla, H. S. (2000). Introduction to Plant Biotechnology. Enfield, NH: Science.</li> <li>• Razdan, M. K. (2003). Introduction to Plant Tissue Culture. Enfield, NH: Science.</li> <li>• Slater, A., Scott, N. W., &amp; Fowler, M. R. (2008). Plant Biotechnology: an Introduction to Genetic Engineering. Oxford: Oxford University Press.</li> <li>• Buchanan, B. B., Gruissem, W., &amp; Jones, R. L. (2015). Biochemistry &amp; Molecular Biology of Plants. Chichester, West Sussex: John Wiley &amp; Sons.</li> <li>• Umesha, S. (2013). Plant Biotechnology. The Energy And Resources.</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-103: Enzyme Biotechnology**

Course Code	BT-103								
Course Title	<b>Enzyme Biotechnology</b>								
Credit	4								
Teaching per week	4 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	The course aims at providing a vision towards advancement in the field of Enzyme Engineering.								
Course Objective	The student will develop an approach for possible ways to extract enzyme and learn about the strategies and techniques for its effective manipulation.								
Course Outcomes	<p>CO1: Students would be acquainted with basics of enzymes and enzymatic reactions. This course also gives them insight about the extraction and purification of enzymes.</p> <p>CO2: This course introduces students about how to use enzymes effectively in the reaction by optimizing various parameters and checking inhibition.</p> <p>CO3: Importance of this course is to make students understand about clinical importance of enzymology and role of inhibitors</p> <p>CO4: This course would develop the skill of making use of enzymes to develop enzyme based chips and also how to perform structural modification in enzymes</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology								
Course Content	<p><b>Unit-1: Introduction to Enzymology</b>            Biocatalysts, Structure of Enzymes, Models for Monosubstrate reaction, Models for Biosubstrate Reactions, Monomeric and Oligomeric Enzymes, Multisubstrate Reactions, Enzyme Localization, Enzyme Assay, Purification of Enzymes from Natural Resources, Fractionation and Characterization of Proteins (Enzymes)</p> <p><b>Unit-2: Enzyme Kinetics and Inhibition</b>            Definition, Order of a Reaction, The Substrate Velocity Plot, The Mechanism Michaelis-Menten, The MM rate Equation, Constants in Enzymes Catalyst Reaction, Transformation of MM Plot into linear plot, Enzyme Inhibitors, Types of Enzymes Inhibition</p>								

	<p><b>Unit-3: Clinical Aspects of Enzymology</b> Introduction, Determination of Enzyme Activities for Clinical Diagnosis, Clinical Enzymology of Liver Diseases, Clinical Enzymology of Heart Diseases, Enzyme Activities in Serum in Diseases, Detection and Significance of Enzyme Deficiencies, Enzyme Inhibitors and Drug Design, Enzyme Immunoassay, Enzyme Therapy</p> <p><b>Unit-4: Enzyme Technology and Enzyme Engineering</b> Production of Enzymes of Interest, Enzyme Reactor, Biosensors and Biochips, Enzyme Electrode, Inhibited Enzyme Electrode, ELISA, Engineered Enzymes, Design tools: Random mutagenesis, DNA shuffling and <i>De NOVO</i> engineering.</p>
Reference Books	<ul style="list-style-type: none"> <li>• T. Palmer and P.L. Bonner, (2007), Enzyme: Biochemistry, Biotechnology and Clinical Chemistry, Woodhead publishing limited.</li> <li>• N.C. Price and L. Stevens, (2002), Fundamentals of Enzymology, Oxford University Press.</li> <li>• Wolfgang Aehle, (2004), Enzyme in Industry: Production and Application (Ed.) Wiley-VCH Verlag GmbH &amp; Co. KGaA.</li> <li>• Branden and Tooze, (1999), Introduction to Proteins Structure, Garland Publishing Group</li> <li>• Gary Walsh, (2014), Proteins: Biochemistry and Biotechnology, John Wiley &amp; Sons Ltd.</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-104 Elective Paper-I: Environmental Biotechnology**

Course Code	BT-104 Elective Paper-I								
Course Title	<b>Environmental Biotechnology</b>								
Credit	4								
Teaching per week	4 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	Environmental Biotechnology is to use bio- based technologies in conjunction with other technologies to prevent, halt, and reverse environmental degradation while emplacing safety precautions as a fundamental component of the programme.								
Course Objective	To conserve the natural resources via recycling waste materials.								
Course Outcomes	<p>CO1: Students will learn how to degrade pollutant dyes from effluents and solid wastes generated by different dyeing industries and also learn how to remove biodegradable material and suspended solid using various technologies.</p> <p>CO2: The purpose of the study is to present a conceptual overview of Phyto technologies and their significance in relation to a variety of environmental issues and potential remedies. It does, however, provide the foundation for a conceptual framework for recognizing the value of ecosystem approaches in achieving sustainable development goals.</p> <p>CO3: Students will learn about bioindicators that are used to monitor the health of the environment and also learn about the prevention of pollution causes by the radiation.</p> <p>CO4: Students will learn about genetic modifications technologies that alter the genetic makeup of living organisms such as animals, plants or bacteria and also learn about genetically modified organism (GMO) which are used for producing genetically modified foods.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basics Science								
Course Content	<p><b>Unit-1: Biotechnology: Food, Dyestuff and Allied industries</b></p> <p>Importance of natural dyes, Problem of dyes in the effluent technologies available for removal of dyes from industrial effluents, Microbial populations associated with treatment of an industrial dye effluent, Nature of effluents from food processing industries, Biological treatment methods for food industry effluents</p>								

	<p><b>Unit-2: Phytotechnology</b> Phytoremediation Approaches, Types of Phytoremediation, Factors influencing Phytoremediation, Cellular Mechanism for Heavy Metals Detoxifications and Tolerance, Phytoremediation-Using Plants to clean up Polluted Soil</p> <p><b>Unit-3: Environmental Pollution: Radiation, Bioindicators and Biological markers</b> Radiation Pollution and Radioactivity, Bioindicators: Uses and Types, Radiation Pollution Prevention: A Case Study of Environment and Heritage Service, Biological Markers: Their use in Quantitative Assessments, Biological marker in medicine</p> <p><b>Unit-4: Genetically Modified Organisms in Environment</b> Genetic Modification – Perspective, Genetic Modified Products – Benefits, Genetic Modified Foods, Ecological and Environmental Impact of Engineered Crops, Environmental Impact of Transgenic Crops – Case Studies, Environmental Risks of GMO, GMO Regulation.</p>
Reference Books	<ul style="list-style-type: none"> <li>• S. N. Jogdand (2006), <i>Environmental Biotechnology</i> (Industrial Pollution Management), Himalaya Publishing House.</li> <li>• R. Marandi and A. Shaeri (2009), <i>Environmental Biotechnology</i>, SBS Publishers &amp; Distributors Pvt Ltd, New Delhi.</li> <li>• M. H. Fulekar (2010), <i>Environmental Biotechnology</i>, Science Publishers.</li> <li>• G. M. Evans and J. C. Furlong (2003), <i>Environmental Biotechnology: Theory and Applications</i>, Wiley Publishers.</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-104 Elective Paper-II: Advances in Nanobiotechnology**

Course Code	BT-104 Elective Paper-II								
Course Title	<b>Advances in Nanobiotechnology</b>								
Credit	4								
Teaching per week	4 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	The course aims at providing a vision towards advancement in the multi-disciplinary field of -Nanobiotechnology.								
Course Objective	The student will gain awareness regarding the possibilities of application, challenges and limitations in the field of nanobiotechnology.								
Course Outcomes	CO1: The unit will give a brief idea of major components and application of nanotechnology that are applicable in biological field. CO2: Students will get to know the structural stability and factors affecting the biomolecules as bionanomachinery CO3: The unit explains the functional aspects of biological systems that may affect the feasibility and application of nanoparticles in the biological world. CO4: The toxicity of nanoparticles in biological as well as under the environmental conditions will be introduced in this unit								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology								
Course Content	<p><b>Unit 1: Components and Applications of Nanobiotechnology</b>            Introduction to Cellular Nanostructures; Nanopores; Biomolecular motors; Nanoparticles for drug delivery, Nanomedicine for neurodegenerative diseases, Therapeutic application of ligand-targeted NPs, Nanoparticles for diagnostics and imaging (theranostics) concepts, nanodevices for biosensor, Bioplotter and 3D printer in Bionanotechnology</p> <p><b>Unit 2: Structural Principles</b>            Structural aspects of biomolecules as bionanomachinery; Forces responsible for structural stability of biomolecules (covalent, hydrogen bonds, electrostatic, hydrophobic). Hierarchical self-assembled nano-structures, self-organisation (Lipid bilayer); membrane, enzyme flexibility as challenge in structural design of nanoparticles.</p>								

	<p><b>Unit 3: Functional Principles</b>  Concepts of smart stimuli responsive nanoparticles, strategies for cellular internalization and long circulation, strategies for enhanced permeation through various anatomical barriers, Nanomaterials use as implants: biological response; nanocomposite scaffolds – bioactive scaffolds – scaffolds for stem cells, Medical Nanorobots</p> <p><b>Unit 4: Nano-toxicity</b>  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.</p>
Reference Books	<ul style="list-style-type: none"> <li>• David S. Goodsell, (2004); Bionanotechnology: Lessons from Nature; Wiley-Liss</li> <li>• Neelina H. Malsch (2005), Biomedical Nanotechnology, CRC Press</li> <li>• Greg T. Hermanson, (2013); Bioconjugate Techniques, (3rd Edition); Elsevier</li> <li>• Madhuri Sharon, Maheshwar Sharon, Sunil Pandey, Goldie Oza, (2012), Bio-Nanotechnology: Concepts and Applications; Ane Books. Pvt. Ltd.</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-105: Practical**

Course Code	BT-105								
Course Title	<b>Practical</b>								
Credit	12								
Teaching per week	4 h X 3 days = 12 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	The set of experiments will give students direct exposure of practical knowledge in the field of Cell culture, Enzyme engineering, Nanobiotechnology and Environmental Biotechnology								
Course Objective	The give students an hands on experience and learn how to plan, execute and draw inference from the practical's								
Course Outcomes	<p>Core Paper: CO1 to CO12: By performing the set of experiments students will learn cell suspension culture, banding, cell counting and viability of cell, cell revival, estimation of phytochemicals and genotoxicity, extraction, immobilisation, optimum reaction conditions and enzyme kinetics.</p> <p>Elective Paper–I: CO1 to CO4: The students will be able to isolate aerobic/anaerobic microbial culture, microbial degradation of heavy metals and visit the site of practical application</p> <p>Elective Paper–II: CO1 to CO4: The students will have hands on experience to synthesize, characterize, and learn the application of nanoparticles.</p>								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basics of Biology, Biotechnology, Biochemistry, Microbiology								
Course Content	<p><b>BT-101 to 103</b>  <b>Core Paper:</b></p> <ol style="list-style-type: none"> <li>1. To perform suspension culture (PBL) and prepare metaphase plate.</li> <li>2. To perform GTG banding and preparation of Karyotype from metaphase plates.</li> <li>3. Isolation of peripheral blood mononuclear cells (PBMC).</li> <li>4. Cell counting and viability.</li> <li>5. Cell culture: Cell revival and its maintenance.</li> <li>6. To perform genotoxicity by micronucleus assay.</li> <li>7. Preparation of plant tissue culture media for <i>in vitro</i> regeneration of anthers.</li> <li>8. Qualitative and quantitative estimation of phytochemicals.</li> <li>9. Determination of optimum reaction conditions for enzyme activity.</li> </ol>								

		<p>10. Enzyme kinetics Michaelis-Menten parameters (substrate concentration).</p> <p>11. Immobilisation of whole cells (Yeast/Bacteria) by calcium alginate method.</p> <p>12. Extraction of enzyme from plant source and assay of enzyme activity.</p>
	<p><b>BT-104</b>  <b>Elective Paper-I</b>  Environmental Biotechnology</p>	<p>1. Isolation and characterisation of microbes from polluted aerobic/ anaerobic habitat.</p> <p>2. Optimisation of microbial degradation of chromium and nickel compounds.</p> <p>3. Degradation of chromium\nickel containing compounds by bacterial cells</p> <p>4. Visit of industrial wastewater treatment plant.</p>
	<p><b>BT-104</b>  <b>Elective Paper-II</b>  Advances in Nanobiotechnology</p>	<p>1. Synthesis of nanoparticles</p> <p>2. Characterisation of synthesised Nanoparticles</p> <p>3. To check anti-microbial activity of synthesised nanoparticles</p> <p>4. Study of Nano-formulations using herbal extract</p>
Reference Books		<ul style="list-style-type: none"> <li>• T. B. Jha and B. Ghosh, (2007); Plant tissue culture basic and applied; Universities press</li> <li>• O.L. Gamborg and G.C. Phillips (2005), Plant cell tissue and organ culture: Fundamental methods, NAROSA publishing house</li> <li>• T. Devasena, (2010); Enzymology; OXFORD university press</li> <li>• R.I. Freshney (2015); Culture of animal cells: a manual of basic technique and specialized applications. John Wiley &amp; Sons.</li> </ul>
Teaching Methodology		Laboratory work, Journal preparation
Evaluation Method		30% Internal assessment based on class attendance, participation, internal examination, etc. 70% External based on semester end University examination

**VEER NARMAD SOUTH GUJARAT UNIVERSITY, SURAT**  
**M. Sc. Integrated Biotechnology Semester-VII**

**Course: BT-106: Techniques for Genetic Testing**

Course Code	BT-106								
Course Title	<b>Techniques for Genetic Testing</b>								
Credit	2								
Teaching per week	2 h								
Minimum weeks per semester	15 weeks (Including Classwork, examination, preparation, holidays etc.)								
Effective from	2022-2023								
Purpose of Course	The purpose of this course is to familiarize students in Human Genetics and Genetic Counselling with genetic techniques “hands-on” using a variety of genetic techniques with a clinical perspective. These genetics techniques are applied to problems in human genetics, such as diagnosis, determining prognosis, family studies and mutation analysis; and used to determination test results, interpretation and reporting findings.								
Course Objective	Students will participate in laboratory exercises to become acquainted with cytogenetics laboratory procedures including cell culture, chromosome preparation, chromosome banding, and karyotyping.								
Course Outcomes	CO1: Upon completion, students will understand the concepts of classical cytogenetic methods including various cell culture methods and chromosomal banding techniques. CO2: Students will be able to locate the specific DNA sequences, diagnosis of genetic diseases, gene mapping, and identification of novel oncogenes or genetic aberrations contributing to various types of cancers. CO3: The students will be able to learn the techniques used for pre-natal genetic testing which will be applied for reproductive health. CO4: Students will understand basics of various sequencing methods and their applications.								
Mapping between COs with PSOs		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8
	CO1								
	CO2								
	CO3								
	CO4								
Pre-requisite	Basics of Biology and Genetics								
Course Content	<b>Unit-1: Techniques in Classical Cytogenetics</b> Peripheral Blood Karyotype, Bone Marrow Karyotype, Different banding techniques (G, Q, C and R Banding)  <b>Unit-2: Advanced Techniques in Cytogenetics</b> Fluorescent <i>in Situ</i> Hybridisation (FISH), Multiplex <i>in Situ</i> Hybridisation (M-FISH), COmbined Binary RAtio- Fluorescent <i>in Situ</i> Hybridisation (COBRA-FISH), Quantitative Fluorescent <i>in Situ</i>								

	<p>Hybridisation (Q-FISH), Spectral Karyotyping (SKY), Comparative Genomic Hybridisation (CGH)</p> <p><b>Unit-3: Genetic Testing used for Reproductive Health</b>  Preimplantation Genetic Testing for Aneuploidy (PGT-A), Preimplantation Genetic Testing for Monogenic disorders (PGT-M), Advanced Comprehensive Chromosome Screening ((Next-Generation Sequencing (NGS), Single Nucleotide Polymorphisms (SNP), Quantitative Reverse Transcription Polymerase Chain Reaction (QT-PCR))</p> <p><b>Unit-4: Sequencing Technology</b>  Sequencing Approaches, Polymerase Chain Reaction (PCR), Sanger Sequencing, Sequencing by synthesis.</p>
Reference Books	<ul style="list-style-type: none"> <li>• Purandare H., Chakravarty A. (2000), Human Cytogenetic Techniques and Clinical Applications.</li> <li>• Russell P.J. (2010), iGenetics- A Molecular Approach, 3rd Edition.</li> <li>• Recent reviews papers and journal articles</li> </ul>
Teaching Methodology	Classwork, Discussion, Self-Study, Seminars and/or Assignment
Evaluation Method	30% Internal assessment based on class attendance, participation, class test, quiz, assignment, seminar, internal examination, etc. 70% External based on semester end University examination