

# VANITA VISHRAM WOMEN'S UNIVERSITY

(Managed By: Vanita Vishram, Surat)

*1<sup>st</sup> Women's University of Gujarat*



VANITA VISHRAM  
WOMEN'S UNIVERSITY

SURAT

## SCHOOL OF SCIENCE AND TECHNOLOGY

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### DEPARTMENT OF BIOTECHNOLOGY

### B.SC. BIOTECHNOLOGY

### SEMESTER 2

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**SYLLABUS**  
**AS PER NEP-2020**  
**W.E.F 2023-24**



EFFECTIVE FROM ACADEMIC YEAR 2023-24

**VANITA VISHRAM WOMEN'S UNIVERSITY, SURAT**  
**SCHOOL OF SCIENCE AND TECHNOLOGY**

**Department of Biotechnology**

**BSc Biotechnology Program**

**FY B.Sc.**

**Semester II**

**BTM203-1C: Introduction to Biotechnology**

**Credit 3 + 1**

**Contact Hour per week 3+2**

**Outline of the Course:**

<b>Course type</b>	Theory/Practical
<b>Purpose of Course</b>	The Purpose of the course is to make students knowledgeable regarding the basics of Biotechnology, its applications and role in various fields, and current status of this field in India.
<b>Course Objective</b>	CO 1: To impart students with knowledge on what is Biotechnology, its various aspects and the scenario of Biotechnology field in India. CO 2: To expose students with various fields and scopes of biotechnology. CO 3: To make students understand regarding the roles and application of Biotechnology in field of healthcare.
<b>Minimum weeks per Semester</b>	15 (Including Class work, examination, preparation, holidays etc.)
<b>Last Review / Revision</b>	Dec 2023
<b>Pre-requisite</b>	Elementary knowledge of Biology.
<b>Teaching Methodology</b>	Class Room Teaching, Discussion and Assignment
<b>Evaluation Method</b>	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)

**Course Content**

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	<b>Understanding Biotechnology</b> <ul style="list-style-type: none"><li>• Definitions of Biotechnology</li><li>• History of Biotechnology</li><li>• Traditional and Modern Biotechnology</li><li>• Biotechnology-three component central role</li><li>• Biotechnology-an Interdisciplinary Pursuit</li><li>• Branches of Biotechnology; Plant, Animal Biotechnology, Marine Biotechnology, Industrial Biotechnology, Medical Biotechnology, Environmental Biotechnology.</li></ul> <b>Biotechnology in India</b> <ul style="list-style-type: none"><li>• Biotechnology Research in India. DBT and Other State Agencies (GSBTM).</li><li>• Biotechnology Institutions in India (Autonomous, Public and Private Sector)</li><li>• Biotech Success Stories- Biocon, Sea6 Energy, Bharat Biotech</li><li>• BTIS-NET</li><li>• ABLE &amp; BIRAC</li><li>• Role of CSIR and ICAR in Biotechnology Research</li></ul>	<b>45%</b>	<b>20</b>
2	<b>Applications of Biotechnology</b> <ul style="list-style-type: none"><li>• Recombinant DNA Technology and Genetic Engineering</li><li>• Applications of Biotechnology in Agriculture:<ul style="list-style-type: none"><li>○ Genetically modified food crops</li><li>○ Example: GM Tomato, Golden Rice etc.</li><li>○ BT Crops (BT Cotton and BT Brinjal: Insect Resistant, Plants: Pros and Cons)</li></ul></li><li>• Biofertilizers</li><li>• Biopesticides</li><li>• Biofuels</li></ul>	<b>35%</b>	<b>15</b>
3	<b>Biotechnology in healthcare</b> <ul style="list-style-type: none"><li>• Vaccines</li><li>• DNA &amp; RNA probes,</li><li>• Monoclonal Antibodies</li><li>• Autoantibodies,</li><li>• Identification of gene causing genetic diseases,</li></ul>	<b>20%</b>	<b>10</b>



	<ul style="list-style-type: none"><li>• Therapeutic molecules from recombinant and non-recombinant organisms (Insulin, human growth hormone, interferon etc.)</li><li>• Gene Therapy</li></ul>		
<p><b>List of References &amp; Text Books:</b></p> <ul style="list-style-type: none"><li>• John Smith (2005) Biotechnology, 5th Edition.</li><li>• Ratledge, C. &amp; Kristiansen, B. (2006) Basic Biotechnology, Cambridge University Press.</li><li>• Gupta, P. K. (2005) Elements of Biotechnology, Rastogi Publications.</li><li>• William Thieman and Michael Palladino (2012). Introduction to Biotechnology (3rd Edition), Benjamin Cummings Publishing Company.</li><li>• B. D. Singh, Biotechnology (2018), Kalyani publishers</li><li>• R.C. Dubey, A Textbook Of Biotechnology (2016) 6th Edition, S Chand publications</li><li>• U Satyanarayana, Biotechnology (2020), Publishers: Books &amp; Allied Ltd</li><li>• Biotechnology by Keshav Trehan</li><li>• Biotechnology: The biological principles M. D. Trevan, S. Boffey, K. H. Goulding &amp; P. Stanbury, Open University Press, Milton Keynes, 1987</li><li>• Sobti and Pachauri (2009) Essential of Biotechnology, Ane Books Pvt. Ltd. ISBN-81- 8052-160-5</li><li>• DBT website: <a href="http://dbtindia.gov.in">http://dbtindia.gov.in</a>.</li></ul>			
<p><b>Practicals:</b></p> <ol style="list-style-type: none"><li>1. Laboratory practices and ethical issues in biotechnology</li><li>2. Demonstration of operation and applications of important instruments (autoclave, incubator, hot air oven, laminar airflow, Colorimeter, bacteriological filter assembly) used in the biotechnology laboratory.</li><li>3. Demonstrate principal and function of centrifuge.</li><li>4. Case study of green revolution and its impact.</li><li>5. Case study of white revolution and its importance.</li><li>6. Calibration, working and use of pH meter.</li><li>7. Demonstration of access of NCBI and DBT website for various information.</li></ol>			
<p><b>References &amp; Textbooks for Practicals</b></p> <ul style="list-style-type: none"><li>• Patel, R. J., &amp; Patel, R. K., (2015). Experimental Microbiology, Vol. 1, 9th ed., Aditya.</li><li>• Cell and Molecular Biology: A Lab Manual. K.V. Chaitanya, PHI Learning Private Ltd.</li><li>• Introduction to practical Biochemistry, David Plummer, Tata McGraw Hill Publishing Company.</li></ul>			

**COURSE OUTCOMES:**

CO 1.	Students will have gain knowledge about origin and detail knowledge about different field in biotechnology and its resources in India
CO 2.	Students will achieve brief information about application in Bioinformatics
CO 3.	Students will aware about use of Biotechnology in health science and its research.

Upon successful completion of the course,

**COURSE OUTCOMES MAPPING**

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	Understanding Biotechnology			
2	Applications of Biotechnology			
3	Biotechnology in healthcare			

**COURSE ARTICULATE MATRIX**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						



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**SCHOOL OF SCIENCE AND TECHNOLOGY**  
**Department of Biotechnology**  
**BSc Biotechnology Program**  
**FY B.Sc.**  
**Semester II**

**BTM204-1C: Biomolecules: Structures & Functions**

**Credit 3 + 1**

**Contact Hour per week 3+2**

**Outline of the Course:**

<b>Course type</b>	Theory/Practical
<b>Purpose of Course</b>	Provide strong fundamentals of structures, functions and organizations of biomolecules in biological systems.
<b>Course Objective</b>	CO 1. Demonstrate knowledge and understanding of the molecular machinery of biomolecules that make living cells CO 2. Demonstrate knowledge and understanding of the principles that govern the structures of biomolecules CO 3. To develop the ability to think critically about Structural and functional moieties of different biomolecules
<b>Minimum weeks per Semester</b>	15 (Including Class work, examination, preparation, holidays etc.)
<b>Last Review / Revision</b>	June 2023
<b>Pre-requisite</b>	Elementary knowledge of Biology.
<b>Teaching Methodology</b>	Class Room Teaching, Discussion and Assignment
<b>Evaluation Method</b>	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)



## Course Content

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	<b>Amino acids:</b> <ul style="list-style-type: none"><li>Structures and Classification of Amino acids</li><li>Chemical &amp; physical properties of amino acids</li><li>Non-standard amino acids</li><li>Zwitter ion and isoelectric point</li><li>Amino acids as drugs</li></ul> <b>Proteins</b> <ul style="list-style-type: none"><li>Types of proteins and their classification</li><li>Forces stabilizing protein structure and shape</li><li>Different Level of structural organization of proteins</li></ul>	33	15
2	<b>Carbohydrate: Structure &amp; Functions:</b> <ul style="list-style-type: none"><li>Definition, Classification, Biological function,</li><li>Structural Characteristics of Carbohydrates: Isomers, Epimers, Enantiomers, Mutarotation</li><li>Monosaccharides: Structural aspects (Open chain and closed chain), types and chemical reactions of Glucose</li><li>Disaccharides: Reducing and non-reducing sugars, Structure of sucrose and lactose</li><li>Polysaccharides: Homopolysaccharides &amp; Heteropolysaccharides</li><li>Mucopolysaccharides, Bacterial cell wall polysaccharides, Over view of glycoproteins &amp; their biological functions</li></ul> <b>Lipids:</b> <ul style="list-style-type: none"><li>Structures &amp; Functions of Lipids</li><li>Classification of Lipids</li><li>Nomenclature of Lipids</li><li>Properties of different types of Lipids: Fatty acids, triacylglycerols, phospholipids, Glycolipids, lipoproteins, cerebrosides, gangliosides, Prostaglandins, Cholesterol, steroids and amphipathic lipids</li></ul>	33	15
3	<b>Nucleic acid:</b> <ul style="list-style-type: none"><li>Types Functions of Nucleic acids: DNA and RNA</li><li>Purines &amp; Pyrimidines</li><li>Nucleosides &amp; Nucleotides</li><li>Biologically important nucleotides</li><li>Double helical model of DNA structure</li><li>Various structural configurations of DNA: A, B &amp; Z</li></ul>	33	15



	<ul style="list-style-type: none"><li>• Physical &amp; chemical properties of Nucleic acids</li><li>• Structural characteristics of RNA</li></ul> <b>Vitamins:</b> <ul style="list-style-type: none"><li>• Nomenclature and classification of vitamins</li><li>• Occurrence and biological functions of – Fat soluble and water-soluble vitamins.</li></ul>		
<b>List of References &amp; Text Books:</b> <ul style="list-style-type: none"><li>• U Satyanarayanan 6th Edition, Biochemistry Elsevier Health Sciences. 2019</li><li>• David L. Nelson, Michael Cox, Aaron Hoskins, Lehninger's Principles of Biochemistry MacMillan Learning. 2021</li><li>• Berg, J. M., Tymoczko, J. L. and Stryer, L. Biochemistry. VI Edition. W.H Freeman and Co. 2006.</li><li>• Voet &amp; Voet, Biochemistry Jhon Willey and sons.2021</li><li>• Lubert Stryer, 9th Edition, Biochemistry, W H freeman</li></ul>			
<b>Practicals:</b> <ol style="list-style-type: none"><li>1. Qualitative tests for Carbohydrates</li><li>2. Quantitative estimation of free amino acids in biological samples by Ninhydrin method.</li><li>3. Qualitative tests for proteins.</li><li>4. Qualitative tests for Lipids: Determination of acid value, iodine value and saponification values of fats &amp; oils.</li><li>5. Biochemical and spectrophotometric estimations of DNA.</li><li>6. Biochemical and spectrophotometric estimations of RNA.</li><li>7. Estimation of vitamin A or vitamin E by colorimetric assay</li></ol>			
<b>References &amp; Textbooks for Practicals</b> <ul style="list-style-type: none"><li>• Rakesh Patel. Experimental Microbiology. Volume</li><li>• S. K. Sawhney, Randhir Singh, Introductory Practical Biochemistry, Alpha Science International. 2005.</li><li>• David T. Plummer, 3rd Edition. An introduction to Practical biochemistry, McGraw Hill Education Pvt Ltd. 2017.</li><li>• Sawhney &amp; Singh. Introductory Practical Biochemistry. Updated edition</li></ul>			





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**SCHOOL OF SCIENCE AND TECHNOLOGY**

**Department of Biotechnology**

**BSc Biotechnology Program**

**FY B.Sc.**

**Semester- II**

**BTE202-1C: Cell Biology (T)**

**Credit 3+1**

**Contact Hour per week 3+2**

**Outline of the Course:**

<b>Course type</b>	Theory/Practical
<b>Purpose of Course</b>	Provide strong fundamentals of eukaryotic cell structures, their organization, division and the roles of organelles in various metabolic aspects of the cell.
<b>Course Objective</b>	CO 4. To demonstrate knowledge and understanding of the eukaryotic cells. CO 5. To make the students aware of structural organization of various cellular organelles and understanding of the roles of various organelles in cellular metabolism. CO 6. To demonstrate how the cell division progress and regulated inside the body.
<b>Minimum weeks per Semester</b>	15
<b>Last Review / Revision</b>	June 2023
<b>Pre-requisite</b>	Elementary knowledge of Biology.
<b>Teaching Methodology</b>	Class Room Teaching, Discussion and Assignment
<b>Evaluation Method</b>	Continuous And Comprehensive Evaluation (CCE) (50%) Semester End Evaluation (SEE) (50%)



**Course Content**

<b>Units</b>	<b>Particulars</b>	<b>% Weightage of Unit</b>	<b>Minimum Nos. of Hours</b>
<b>1</b>	<p><b>Introduction to Cell Biology</b></p> <ul style="list-style-type: none"> <li>• Origin and Evolution of Cells</li> <li>• Endosymbiont Theory</li> <li>• Cell Diversity</li> <li>• Cell Theory</li> <li>• Basic Properties of cells</li> </ul> <p><b>Structure and Function of Cell Components</b></p> <ul style="list-style-type: none"> <li>• Eukaryotic cell wall</li> <li>• Plasma Membrane</li> <li>• Nucleus</li> <li>• Mitochondria</li> <li>• Chloroplast and other Plastids</li> <li>• Endoplasmic Reticulum</li> <li>• Golgi Complex</li> </ul>	<b>45</b>	<b>20</b>
<b>2</b>	<p><b>Structure and Function of Cell Components</b></p> <ul style="list-style-type: none"> <li>• Lysosomes</li> <li>• Peroxisomes</li> <li>• Cytoskeleton</li> <li>• Microtubules</li> <li>• Intermediate Filaments</li> <li>• Microfilaments</li> <li>• Centrosomes</li> </ul>	<b>33</b>	<b>15</b>
<b>3</b>	<p><b>Extracellular Matrix and Cell Interactions</b></p> <ul style="list-style-type: none"> <li>• ECM: (Matrix Structural Proteins, Polysaccharides, Adhesion Proteins)</li> <li>• Cell-matrix Interactions</li> <li>• Cell-cell Interactions (Adhesion Junctions, Tight Junctions, Gap Junctions, Plasmodesmata)</li> </ul> <p><b>Cell Cycle, Regulation &amp; Cell Division</b></p> <ul style="list-style-type: none"> <li>• Cell cycle: Overview, Phases, Regulation &amp; Control of cell cycle</li> <li>• Overview and basic steps of Mitosis</li> <li>• Overview and basic steps of Meiosis</li> <li>• Genetic recombination during Meiosis</li> </ul>	<b>22</b>	<b>10</b>
<p><b>List of References &amp; Text Books:</b></p> <ul style="list-style-type: none"> <li>• Karp, G. (2016). Cell and molecular biology: concepts and experiments. John Wiley &amp; Sons, ISBN-978-1-118-88614-4</li> <li>• Cooper, G. M., &amp; Hausman, R. E. (2004). The cell: a molecular approach. ISBN-0878932143</li> </ul>			



- Verma, P. S., & Agarwal, V. K. (2004). Cell Biology, Genetics, Molecular Biology, Evolution and Ecology: Evolution and Ecology. S. Chand Publishing. ISBN-978-8121924429
- John P. Harley, Donald A. Klein, Microbiology- Lansing Prescott, 10th Edition, Mcgraw Hill Publication. ISBN-13-978-1259281594

**Practicals:**

1. To visualize animal and plant cell using methylene blue.
2. To study viability of cells using trypan blue/phenol red.
3. To perform Staining of DNA by Schiff's reagent using onion peel.
4. To study Lipid solubility of membranes using hypotonic solution and RBCs.
5. To study mitosis in onion root tips.
6. To observe Barr body from buccal smear.
7. To perform Giemsa staining of blood cells.
8. Demonstration of preparation of nuclear, mitochondrial and cytoplasmic fractions.

**References & Textbooks for Practical**

- Cell and Molecular Biology: A Lab Manual. K.V. Chaitanya, PHI Learning Private Ltd.

**COURSE OUTCOMES:**

CO 1.	Students will have gain knowledge about origin and evolution of cells and their important properties.
CO 2.	Students will achieve brief information and understanding about various components of cells, and their functional and structural analysis
CO 3.	Students will be able to study cell-cell interaction techniques, cell division and cell regulations

**COURSE OUTCOMES MAPPING**

Unit No.	Title of the Unit	Course Outcomes		
		CO 1	CO 2	CO 3
1	Introduction to cell Biology			
2	Structure and function of cell components			
3	Extracellular Matrix and Cell Interactions & Cell Cycle, Regulation & Cell Division			

**COURSE ARTICULATE MATRIX**

	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6
CO1						
CO2						
CO3						



**VANITA VISHRAM WOMEN'S UNIVERSITY, SURAT**  
**SCHOOL OF SCIENCE AND TECHNOLOGY**

**Department of Biotechnology**

**Environmental studies**

**FY B.Sc./B.A./B.Com./B.C.A./B.Voc/B.B.A**

**Semester II**

**VAC201-1C: Environmental studies**

**Credit 2**

**Contact Hour per week 2**

**Outline of the Course:**

<b>Course type</b>	Theory
<b>Purpose of Course</b>	The students need to learn basic concepts of environment. How environment impact our life on earth and which activities are harmful to our environment and how we can contribute to wellbeing of our earth and environment.
<b>Course Objective</b>	CO 1. To develop the understanding basics concept of our environment and its sustainable development. CO 2. Demonstrate knowledge and understanding different component of environment. CO 3. Demonstrate knowledge and understanding of the ecosystem and its functioning and impact on survival of organism on earth. CO 4. To develop the ability to think critically about sustainable development of our earth environment.
<b>Minimum weeks per Semester</b>	15 (Including Class work, examination, preparation, holidays etc.)
<b>Last Review / Revision</b>	Dec 2023
<b>Pre-requisite</b>	10+2
<b>Teaching Methodology</b>	Class Room Teaching, Discussion and Assignment
<b>Evaluation Method</b>	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)

**Course Content**

<b>Units</b>	<b>Particulars</b>	<b>% Weightage of Unit</b>	<b>Minimum Nos. of Hours</b>
<b>1</b>	<b>Introduction of Environment</b> <ul style="list-style-type: none"><li>• Definition and multidisciplinary nature of environmental studies.</li><li>• Concept and Components of environment (Atmosphere, Lithosphere and Hydrosphere)</li><li>• Bio-geochemical cycles</li><li>• Concept, structure and function of an ecosystem.</li><li>• Food chains, food webs and Energy flow in an ecosystem</li><li>• Terrestrial ecosystem: Forest ecosystem and Grassland ecosystem</li><li>• Aquatic ecosystems: Pond and ocean ecosystem</li></ul>	<b>25</b>	<b>8</b>
<b>2</b>	<b>Natural Resources: Renewable and Non-renewable Resources</b> <ul style="list-style-type: none"><li>• Land as a resource, soil erosion and land degradation, landslides, and desertification</li><li>• Forests: Use and over-exploitation, deforestation,</li><li>• Impacts of deforestation on biodiversity and tribal populations.</li><li>• Energy resources: Renewable and non-renewable energy sources, use of alternate energy sources, growing energy needs.</li></ul>	<b>25</b>	<b>8</b>
<b>3</b>	<b>Biodiversity and its Conservation</b> <ul style="list-style-type: none"><li>• Introduction — Definition, ecosystem diversity, Value of biodiversity,</li><li>• India as a mega-biodiversity nation;</li><li>• Threats to biodiversity: Habitat loss, poaching of wildlife, man- wildlife conflicts.</li><li>• Endangered and endemic species of India. Common plant and animal species.</li><li>• Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity</li></ul>	<b>25</b>	<b>7</b>
<b>4</b>	<b>Environmental pollution</b> Definition Causes, effects and control measures of: <ul style="list-style-type: none"><li>• Air pollution</li><li>• Water pollution</li><li>• Soil pollution</li><li>• Marine</li></ul>	<b>25</b>	<b>7</b>



	<ul style="list-style-type: none"> <li>Noise pollution</li> <li>Thermal pollution</li> <li>Nuclear hazards</li> </ul>		
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**List of References & Text Books:**

- Bharucha, E. (2013). Textbook of Environmental Studies for Undergraduate Courses. Universities Press.
- Asthana, D. K. (2006). Text Book of Environmental Studies. S. Chand Publishing.
- Basu, M., Xavier, S. (2016). Fundamentals of Environmental Studies, Cambridge University Press, India
- Singh, J.S., Singh, S.P. & Gupta, S.R. 2006. Ecology, Environment and Resource Conservation. Anamaya Publications.
- Sodhi, N.S. & Ehrlich, P.R. (Eds). 2010. Conservation Biology for All. Oxford University Press.
- Tiwari, G.N. & Ghosal. M. K. 2005. Renewable Energy Resources: Basic Principles and Application. Narosa Publishing House.
- R. K. Khitoliya., 2012. Environmental Pollution 2nd edition. S. Chand Publishing
- Pepper, I.L., Gerba, C.P. & Brusseau, M.L. 2006. Environmental and Pollution Science. Elsevier Academic Press.
- Purohit, S.S. & Ranjan, R. 2007. Ecology, Environment & Pollution. Agrobios Publications.

**COURSE OUTCOMES:**

CO 1.	Students will gain knowledge about Earth structure and its environment and ecology and biodiversity and its role in human welfare and its conservation
CO 2.	Students will develop the understanding about various natural resources and their management.
CO 3.	Students will be able to critically examine all sides of environmental issues and apply understanding from various disciplines such as psychology, law, literature, politics, sociology, philosophy, and religion to create opinions about how to interact with the environment on both a personal and a social level.
CO 4.	Students will understand the global character of environmental problems and ways of addressing them, including interactions across local to global scales.

**COURSE OUTCOMES MAPPING**

Unit No.	Title of the Unit	Course Outcomes			
		CO 1	CO 2	CO 3	CO 4
1	Introduction of Environment				
2	Natural Resources: Renewable and Non-renewable Resources				
3	Biodiversity and Conservation				
4	Environmental pollution				