VANITA VISHRAM WOMEN'S UNIVERSITY

SCHOOL OF SCIENCES AND TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY

BACHELOR OF SCIENCE (B.SC.) HONOURS BIOTECHNOLOGY PROGRAMME

Under Learning Outcomes-based Curriculum Framework (LOCF) for Under Graduate (UG) Education

SEMESTER 1

Core Courses (CC)

Syllabus applicable to the students seeking admission in the following programme

B.Sc. Biotechnology under LOCF w.e.f. the Academic Year 2021-2022

1. Preamble – VVWU

Vanita Vishram Women's University (VVWU) is the First-ever Women's University of Gujarat approved by the Government of Gujarat under the provisions of the Gujarat Private Universities Act, 2009. It is a University committed to achieve Women's Empowerment through Quality Education, Skill Development, and by providing employment opportunities to its girl students through its model curriculum, integration of technology in pedagogy and best-in-class infrastructure. The focus is on prioritizing practical component and experiential learning supported through academia-industry linkages, functional MoUs, skill development training, internships etc. It aims at providing opportunities to the girl students for holistic development and self-reliance.

VISION

Empowerment of women through quality education and skill development, so as to make them strong pillars of stability in the society.

MISSION

To provide Education & Professional Training to all women for their all-round development, so as to enable them to become economically independent and socially empowered citizens.

2. Introduction of the Program

B. Sc (Hons) Biotechnology is a three years UG degree program. It involves the study of living organisms, biological systems and use of advanced technology to study the same. The course can create professionals who could improve the quality of human life and the health of the planet by the products of biotechnology. Biotechnology is a broad discipline in which biological processes, organisms, cells or cellular components are exploited to develop new technologies. New tools and products developed by biotechnologists are useful in research, medicine (development of new medicines, vaccines, hormones, insulin therapies etc.), agriculture (development of genetically modified plants i.e BT cotton, seedless fruits; biofuels, biological treatment, biofertilizers etc.) environment (biofuels, waste water treatment, biodegradation of hydrocarbons, pesticides etc.) and industry (production of chemicals, paper, textiles and food). Depending on the tools and applications, it often overlaps with related scientific fields. In the late 20th and early 21st centuries, biotechnology has expanded to include new and diverse sciences, such as genomics, recombinant gene techniques, applied immunology, bioinformatics, biostatistics, microbiology, biochemistry and development of pharmaceutical therapies and diagnostic tests.

3. Programme Specific Objectives (PSOs)

- To give the knowledge of biological science, technology as well as entrepreneur skills to apply it for human welfare.
- To strengthen the fundamentals in basic subjects through in-house state of art laboratory exposures and project work fostering global competencies among students.
- To develop critical thinking, an ability to solve, analyze and interpret data generated from experiments to meet the need of industry and research.
- To make learners understand about bioethical aspects, safety aspects and their responsibilities towards the mankind and environments.
- To enhance career opportunities in academy and industry by providing hands on practice in all the disciplines of biotechnology to young aspirant.

4. Programme Specific Outcomes (PSOs)

Upon completion of the B. Sc (Hons) Biotechnology program, the learner should be able to:

- Understand the concepts and research approaches for their higher career in the field of biotechnology and develop their scientific interest.
- Apply knowledge for in-depth analytical and critical thinking to identify and resolve the problems related to Biotechnology Industry, Medical or hospital related organizations, Regulatory Agencies, Environmental problems & Academia.
- Demonstrate skills to use modern analytical tools/ software/ equipment's and analyze the results used in industry and research through an inter-disciplinary learning habitat.
- Appreciate and execute their professional roles in society as biotechnology professionals, employers and employees in various industries, regulators, researchers, educators and managers.
- Adopt code of ethics in professional and social context and demonstrate exemplary professional, ethical and legal behavior in decision making.

5. Structure of the Program

B.SC. BIOTECHNOLOGY HONOURS STRUCTURE & DISTRIBUTION OF COURSES							
Courses	**Theory (Credits)**	**Practical (Credits)**	**Courses**	**Theory (Credits)**	**Practical (Credits)**	**Total Theory & Practical Credits**	**Total yearly Credits**
SEM1			**SEM2**				
CC1	4	2	CC3	4	2		
CC2	4	2	CC4	4	2		
GE1	4	2	GE2	4	2		
AECC1	2	-	AECC1	2	-		
AECC2	2	-	AECC2	2	-		
	16	**6**		**16**	**6**	**32+12**	**44**
SEM3			**SEM4**				
CC5	4	2	CC8	4	2		
CC6	4	2	CC9	4	2		
CC7	4	2	CC10	4	2		
GE3	4	2	GE4	4	2		
SEC1	4	-	SEC2	4	-		
	20	**8**		**20**	**8**	**40+16**	**56**
SEM5			**SEM6**				
CC11	4	2	CC13	4	2		
CC12	4	2	CC14	4	2		
DSE1	4	2	DSE3	4	2		
DSE2	4	2	DSE4	4	2		
	16	**8**		**16**	**8**	**32+16**	**48**
Total (Theory + Practical)						**104+44**	**148**

6. Structure of the Course

B.SC. BIOTECHNOLOGY HONOURS (SEMESTERS 1 & 2)					
Sem	**Core Course**	**Ability Enhancement Course**	**Skill Enhancement Course**	**Discipline Specific Elective Course**	**Generic Elective Course**
1	**CC1**-Introduction to Biotechnology	**AECC1-** Communication skills in English - I	-	**-**	**GEC1-** Ecology and Environment Management
	CC2- Basics of Biochemistry	**AECC2-** Environmental studies - I	-	-	-
2	**CC3-** Cell Biology	**AECC1-** Communication skills in English - II	-	-	**GEC2**-Marine Biotechnology
	CC4- Eukaryotic Physiology	**AECC2-** Environmental studies - II	**-**	-	-

BACHELOR OF SCIENCE (B.SC.) BIOTECHNOLOGY HONOURS

SEMESTER 1
CORE COURSE PAPER 1

INTRODUCTION TO BIOTECHNOLOGY

Course Objectives:

1. To give idea about the Biotechnology and a detailed understanding of the field.
2. To explore the interdisciplinary nature of the biotechnology.
3. To identify the ways by which biotechnology can help the humans.
4. To spread awareness among the learners about the development of biotechnology in India.

Course Outcome:

1. Students will be able to define the term Biotechnology and its scope.
2. Students will have an awareness of the significance of biotechnology and its related industry.
3. Students will have an understanding on how biotechnology is related to us and where we are using biotechnology in daily life.
4. Students will be able to understand the relation of biotechnology with other sciences i.e., genetics, microbiology, immunology, bioinformatics, environment, animal & plant science etc.
5. Have an awareness of some of the current and future issues surrounding the relationship between biotechnology and government, investors, the environment and consumers and the impact of these on the development of future biotechnology industry.

BT11010 - THEORY COURSE CONTENT
(4 Credits)

UNIT1	What is Biotechnology, Biotechnology-an interdisciplinary pursuit, Biotechnology- a three-component central core, Product safety, public perception of Biotechnology, Biotechnology and developing world	10 lectures
UNIT2	Recombinant DNA technology and genetic engineering, genetically modified organisms, Bioinformatics, Animal cell culture, Plant cell culture, Forensic science, Food and dairy Biotechnology, Waste Water and Sewage treatment, Aquatic biotechnology	20 lectures
UNIT3	Industrial Biotechnology (Fermentation, Bio-fertilizer & Bio-pesticides), Environment & Biotechnology (Bioremediation, Bio-fuels, Bio-catalysis), Human health & Biotechnology (Vaccines, Monoclonal antibodies, Diagnostics in developing countries)	20 lectures
UNIT4	Introduction to DBT, Autonomous institutions of DBT, Public sectors undertaking of DBT, BTIS-NET, Introduction to ABLE, Biotechnology-Current status of industrial growth in India	10 lectures

BT11030 - LAB COURSE CONTENT
(2 Credits)

1. Biotechnology lab safety and lab rules.
2. Introduction to various Laboratory Apparatus viz. pH meter, Colorimeter, Spectrophotometer, Centrifuge, Laminar air flow, Electrophoresis unit, Gel documentation unit, Thermo cycler, ELISA reader, Incubator, Hot air oven, Autoclave, Anaerobic jar.
3. Calibration of glass wares (beakers, pipettes, measuring cylinder and flask).
4. Preparation of laboratory reagents and solutions.
5. Study of light microscope and principle of microscopy.
6. Principles of Colorimetry**: (i)** Verification of Beer's law, (**ii)** To study relation between absorbance and % transmission.
7. Bread making.
8. Introduction on transgenic crop (Ex-BT- cotton) and animal (Ex – Dolly sheep).
9. Demonstration on isolation of nitrogen fixing bacteria and phosphate solubilize bacteria.
10. Demonstration on protein separation by SDS page.
11. Demonstration of DNA extraction and separation by gel electrophoresis.
12. Case study on Ethical issues of Biotechnology.

SUGGESTED READING

1. John Smith (2005) Biotechnology, 5th Edition.
2. Ratledge, C. & Kristiansen, B. (2006) *Basic Biotechnology*, Cambridge University Press.
3. Gupta, P. K. (2005) *Elements of Biotechnology*, Rastogi Publications.
4. William Thieman and Michael Palladino (2012). Introduction to Biotechnology (3rd Edition), Benjamin Cummings Publishing Company. ISBN: 9780321766113
5. Purohit, S. S. (2005). Biotechnology: Fundamentals and Applications (4th Edition). Agrobios India.
6. DBT website: http://dbtindia.gov.in/
7. Patel, R. J., Experimental Microbiology Vol 1 & 2 (5th Edition), Aditya Publication.
8. Sadasivam S. and Manickam A., Biochemical Methods (2nd Edition), New age International Publication).

SEMESTER 1
CORE COURSE PAPER 2

BASICS OF BIOCHEMISTRY

Course Objectives:

1. To make the students aware about foundations of biochemistry and role of water in biochemistry.
2. Students will be given knowledge of biomolecules, their structure and role in cell functioning.
3. Through this course the students are exposed to importance of biological macromolecules.
4. This course presents the chemical reactions or metabolic functions in the living system and their regulations.
5. To make the student to understood the concept of biochemical regulations, synthesis and degradation of biomolecules in the cell.

Course Outcome:

After the successful completion of the course, students will be able to,

1. Explain the definition, classification, biological function, structure and interactions of Biomolecules.
2. Discuss and differentiate the basic structure & function of cellular macromolecules in the cells.
3. Analyze the functioning of life at molecular level.
4. Gain knowledge about structure and different forms of various biomolecules in the biological systems.
5. Apply the knowledge to control & regulate the various metabolic pathways & reactions of cell.

BT11020 - THEORY COURSE CONTENT
(4 Credits)

UNIT1	Evolutionary foundations, Chemical foundations, Physical foundations	10 lectures
UNIT2	**Water:** Weak Interactions in Aqueous Systems, Ionization of Water, Weak Acids and Weak Bases, buffering against pH Changes in Biological Systems, Water as a Reactant, The Fitness of the Aqueous Environment for Living Organisms	10 lectures
UNIT3	**Amino acids & Proteins:** Structure, functions and properties of Amino acids, Types of proteins and their classification, Forces stabilizing protein structure and shape, Different Level of structural organization of proteins, Protein Purification **Carbohydrates:** Structure & Function, Monosaccharide and Disaccharides, Polysaccharides, Glycoconjugates (Proteoglycans, Glycoproteins, Glycolipids)	20 lectures

UNIT4	**Lipids**: Structure and functions, Classification, nomenclature and properties of fatty acids, essential fatty acids, Phospholipids, sphingolipids, glycolipids, cerebrosides, gangliosides, Prostaglandins, Cholesterol **Nucleic acids**: Structure and functions, Physical & chemical properties of Nucleic acids, Nucleosides & Nucleotides, purines & pyrimidine, biologically important nucleotides, Double helical model of DNA structure and forces responsible for A, B & Z – DNA denaturation and renaturation of DNA	20 lectures

BT11040 - LAB COURSE CONTENT
(2 Credits)

1. Preparation of molar, normal, molal, ppm, % v/v, and % w/v solutions.
2. Qualitative tests for Carbohydrates.
3. Qualitative tests for Proteins.
4. Qualitative tests for Lipids.
5. Estimation of sugar DNSA method.
6. Estimation of sugar by Cole's method.
7. Estimation of blood glucose by glucose oxidase method.
8. Estimation of proteins by Bradford/Lowry's method.
9. Estimation of saponification value.
10. Determination of acid value of oil & fat.
11. Estimation of DNA by DPA method.
12. Estimation of RNA by orcinol method.
13. Separation of amino acids/ carbohydrates by paper chromatography.
14. Separation of amino acids/ carbohydrates by thin layer chromatography.

SUGGESTED READING

1. Berg, J. M., Tymoczko, J. L. and Stryer, L. (2006). Biochemistry. VI Edition. W.H Freeman and Co.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants.American Society of Plant Biologists.
3. Nelson, D.L., Cox, M.M. (2004) Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
4. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John Wiley and Sons.
5. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.
6. Plummer, D. T., An Introduction to Practical Biochemistry, 3rd Edition, McGrawHill Publication.
7. Patel, R. J., Experimental Microbiology Vol 1 & 2 (5th Edition), Aditya Publication.
8. Sadasivam S. and Manickam A., Biochemical Methods (2nd Edition), New age International Publication).

8. Teaching Methodology

Teaching methodology/ knowledge delivery method is very important in conveying knowledge to the learner. It is very vital to get maximum result from them. So, it is good to choose the methods which bests suits to a learner. Teacher can use various techniques and technology to makes the learner better understand.

- Teaching can be done by lectures, by traditional chalk and talk method, by general discussion and/or by using latest technology such as overhead projectors, digital board etc.
- For the better understanding of any topic, teachers can use charts and models. It can ease the imagination and visualization of the topic.
- Students can be given practical exposures or demonstration on the topics of curricula.
- Self-learning is also important aspect of teaching methodology because it allows the learner to learn by their own efforts and mistakes. Here, one can give group activity, assignments or activity on specific subject.
- Problem solving exercise or tutorials are also helpful in conveying knowledge by developing the thought process and thinking capacity of the learners,
- We also can encourage the students for quiz competition, presentation, group discussion on recent advances in the related fields.
- Field visits/internship/training is a very effective way to convey knowledge to any student. This can prepare the learner as a professional.
- Guest lecture, seminar, webinar can be conducted to enhance the knowledge of learner.
- Learners can be evaluated time to time by weekly tests, class tests, written tests, viva-voce, presentation etc. to get enhanced output. Grading and certificates can provide a motive to learner to learn more and more to prove themselves better.