

**Karnataka State Akkamahadevi Women's
University, Vijayapura**



BIOTECHNOLOGY
(M.Sc.)

(I to IV Semesters)

Approved through online BOS on 19.08.2022

2022-23 onwards
(19.08.2022)

DEPARTMENT OF BIOTECHNOLOGY

**KARNATAKA STATE AKKAMAHADEVI WOMEN'S UNIVERSITY,
VIJAYAPURA**

University Vision:

Empowerment of women through education

University Mission:

- To provide quality education and impart professional and vocational skills to enable women to be self reliant and meet the challenges of the changing socio-economic needs
- To promote personality development and leadership qualities with a balanced outlook towards society
- To help women enrich their knowledge and reap the benefits of knowledge power

Department Vision

The department has a vision, which we believe to be both commendable and achievable. To initiate a level of attitude in students that will provide solutions to environmental, industrial, agricultural and health-based problems. To graduate women who can compete, with advantage, within the relevant academic and commercial markets in the world.

Department Mission

Our mission is to provide our students with an education that establishes a strong foundation and appreciation for understanding developments in the rapidly advancing field of biotechnology, to develop the technical and critical thinking skills necessary for success in the field, to foster ethical behavior, and to promote outreach, providing the nation with highly trained professional who are able to implement the scientific principles to the continuous improvement of the safe, quality and value biotechnological services and products. We seek to provide a responsive learning environment of creative thinking that enables all students to achieve their highest level of proficiency.

Department Objectives

- To create an enabling learning environment in order to foster a knowledge pool and research culture as well as provide required support through research framework and guidelines.
- To foster students with theoretical, practical and industrial knowledge to make them employable and industry ready.
- To ensure high level of efficient and effective support system to facilitate faculty and researchers in their research activities.
- To promote and encourage students and faculty to publish articles in peer reviewed quality reputed journals, indexed in Scopus/Web of Science and/or with impact factor.
- To engage students and staff in collaborative research and training nationally and globally through linkages and MoUs.
- To promote students and faculty exchange with esteemed research.
- To encourage students and faculty to undertake research those have societal implications.
- Establish state of the art research facility in the department.

M.Sc. Biotechnology Program Overview

The Department of Biotechnology at Karnataka State Akkamahadevi Women's University imparts quality education through theoretical, practical and industrial exposure in order to enhance the students' knowledge in biotechnology as well as advanced biology. Biotechnology harnesses the core principles of engineering living organisms to generate controlled processes or products for human and environmental welfare related to the environment, biopharmaceutical, industrial, healthcare, food or agro-industries. The unique course structure is designed in consultation with clinical, agricultural and industrial experts to give you the cutting edge specialist knowledge and practical skills needed for a career in molecular biosciences. Through this Biotechnology program students are prepared with in-depth and wide knowledge related to biotechnology and its applications, as well as the next generation of scholars and teachers. This program covers teaching and research fields of specialization include Animal Cell Culture, Plant Tissue Culture, Phytochemistry, Nanotechnology, Fermentation technology, Bioprocess engineering, Biochemistry, Bacteriology, Cell biology, Cell signaling, Molecular biology, Genetics, Bioinformatics,

Genomics, Proteomics, Parasitology, Plant science, Virology, Systems and Synthetic biology. The M.Sc. Biotechnology program at KSWUV will be unique, as it will cover all the major fields of Biotechnology, while focusing on laboratory practical experiences and industrial exposure with research skills. The students will be introduced to the concepts of “Entrepreneurship and start-ups”. This allows students employability and further establishes their own new biotechnology enterprise. The overall aim of this program is to effectively engage students in learning, enhance their problem solving skills, to get deeper understanding of the discipline.

Program Outcomes (POs)

PO1	Ability to carry out research /investigation independently in specialized area of Biotechnology.
PO2	Ability to write and present a substantial technical report/document.
PO3	Ability to demonstrate a degree of mastery in the area of biotechnology to enable them in collaborative and multidisciplinary research.
PO4	Learn to recognise the need for continuous learning and will prepare oneself to create, select, learn and apply appropriate techniques, resources, and modern instrumentation to carry complex biotechnological activities with an understanding of the limitations.
PO5	Ability to manage projects efficiently and economically with intellectual integrity and ethics for sustainable development of society.

Scheme of Teaching, Examination and Credit points of
M.Sc. Biotechnology Programme w.e.f. 2021-22

Semester	Paper No. and Title	Teaching Hrs/week	Internal Assessment	Exam Hrs	Exam Marks	Total Marks
I	HCT-1.1: Cell Biology	04	30	03	70	100
	HCT-1.2: Biochemistry	04	30	03	70	100
	HCT-1.3: Biophysical and Biochemical techniques	04	30	03	70	100
	SCT-1.4: a: Bioinformatics		30	03	70	100
	SCT-1.4: b: Biostatistics					
	SCT-1.4: c: Enzymology					
	HCP-1.1: Cell Biology	04	30	04	70	100
	HCP-1.2: Biochemistry	04	30	04	70	100
	HCP-1.3: Biophysical and Biochemical techniques	04	30	04	70	100
	SCP-1.4: Based on soft core paper - SCT 1.4	04	30	04	70	100
OET -1.5: Basic Biotechnology	04	30	03	70	100	
	Total		270		630	900
II	HCT-2.1: Molecular Biology	04	30	03	70	100
	HCT-2.2: Microbiology	04	30	03	70	100
	HCT-2.3: Immunology	04	30	03	70	100
	SCT-2.4: a. Research Methodology Bioethics and IPR	04	30	03	70	100
	SCT-2.4: b Enzymology					
	SCT-2.4: c. Biotechnology and human welfare					
	HCP-2.1: Molecular Biology	04	30	03	70	100
	HCP-2.2: Microbiology	04	30	03	70	100
	HCP-2.3: Immunology	04	30	03	70	100
	SCP-2.4: Based on soft-core paper – SCT 2.4	04	30	03	70	100
OET-2.6: Biotechnology and human welfare	04	30	03	70	100	
	Total		270		630	900
III	HCT-3.1: Genetic Engineering	04	30	03	70	100
	HCT-3.2: Plant Biotechnology	04	30	03	70	100
	SCT-3.3: a. Animal Biotechnology	04	30	03	70	100
	SCT-3.3: b. Phytopharmacology					
	SCT-3.3: c. NanoBiotechnology					
	HCP-3.1: Genetic Engineering	04	30	03	70	100
	HCP-3.2: Plant Biotechnology	04	30	03	70	100
	SCP-3.3: Based on soft-core paper – SCT 3.3	04	30	03	70	100
	HCP-3.4: Entrepreneurship and Startup Studies *	04	--	--	50	50
OET-3.5: Applied Biotechnology	04	30	03	70	100	
	Total		210		540	750
IV	HCT-4.1: Medical Biotechnology and Clinical Research	04	30	03	70	100
	SCT-4.2: a. Industrial Biotechnology	04	30	03	70	100
	SCT-4.2: b. Vaccine Technology					
	SCT-4.2: c. Food Technology					
	HCPW-4.3: Project work*	06	50	--	100	150
	HCP-4.1: Medical Biotechnology and Clinical Research	04	30	03	70	100
	SCP-4.2. Based on soft-core paper – SCT 4.2	04	30	03	70	100
OET 4.4 Bioinstrumentation	04	30	03	70	100	
	Total		200		450	650
	Total Marks: 3200					

HCT: Hard Core Theory; SCT: Soft Core Theory; HCP: Hard Core Practical, HCPW: Project Work and Dissertation, OET: Open Elective Theory

Semester	Paper No. and Title	Course Outcome
I	HCT-1.1: Cell Biology	<ol style="list-style-type: none"> 1. Acquire knowledge about the organizational and functional aspects of cell and cell organelles. 2. Learn about the interactions of the cells with outside environment through exchange of information and transport of molecules. 3. Learn about the classical genetics and transmission of characters from one generation to the next which will make foundation for the advanced genetics. 4. Develop innovative research ideas for curing genetic disorders in humans.
I	HCT-1.2: Biochemistry	<ol style="list-style-type: none"> 1. Know the chemical constituents of cells, the basic units of living organisms. 2. Explain various types of weak interactions between the biomolecules. 3. Know how the simple precursors give rise to large biomolecules such as proteins, carbohydrates, lipids, nucleic acids. 4. Correlate the structure-function relationship in various biomolecules. 5. Know the role of biomolecules for orderly structures of the cells/tissues.
I	HCT-1.3: Biophysical and Biochemical techniques	<ol style="list-style-type: none"> 1. Concept of electromagnetic radiation, absorption spectrum, Beer's law and Lamberts law. 2. Principle, working and applications of spectrophotometer and AAS. 3. Concepts of chromatography and concept of partition coefficient. 4. Principle, methodology and application of various chromatographic techniques. 5. Principle, methodologies and application of electrophoric separation of biomolecules.
I	SCT-1.4 a: Bioinformatics	<ol style="list-style-type: none"> 1. Describe the important computer system resources and the role of operating system in their management policies and algorithms. 2. Understand the process management policies and scheduling of processes by CPU 3. Evaluate the requirement for process synchronization and coordination handled by operating system 4. Describe and analyze the memory management and its allocation policies. 5. Identify use and evaluate the storage management policies with respect to different storage management technologies. 6. Identify the need to create the special purpose operating system.
I	SCT-1.4 b: Biostatistics	<ol style="list-style-type: none"> 1. Defining the type and quantity of data need to be collected. 2. Organizing and summarizing the data. 3. Analyzing the data and drawing conclusions from it. 4. Assessing the strengths of the conclusions and evaluating their uncertainty.
I	SCT-1.4 c: Enzymology	<ol style="list-style-type: none"> 1. It helps the students to learn the significant features of the biochemical catalyts. 2. It helps the students to learn the methodology involved in assessing the enzyme activity and mechanism of enzyme action. 3. It illustrates the enzyme catalysis, kinetics and regulatory aspects.
I	HCP-1.1: Cell Biology	<ol style="list-style-type: none"> 1. This gives them a strong foundation on the basic unit of life. 2. At the end of the course, the student has a strong foundation on the functions of the cell.
I	HCP-1.2: Biochemistry	<ol style="list-style-type: none"> 1. They acquire knowledge in the quantitative and qualitative estimation of biomolecules 2. They study the influence and role of structure in reactivity of biomolecules 3. At the end of the course, the students have a thorough understanding on the role of biomolecules and their functions
I	HCP-1.3: Biophysical	<ol style="list-style-type: none"> 1. This skill based course will teach the students the various instrumentations that are used in

	and Biochemical techniques	<p>the analytical laboratories.</p> <ol style="list-style-type: none"> On completion of the course, students will be able to understand: biophysical techniques for carrying out research in life sciences.
I	SCP-1.4: Bioinformatics	<ol style="list-style-type: none"> Introduces the students to concepts in bioinformatics The student will be able to apply basic principles of biology, computer science and mathematics to address complex biological problems Introduces the students to the basics of computer operations The student is imparted with knowledge on both hardware and software. The student has a better understanding on the use of computers for various applications
II	HCT-2.1: Molecular Biology	<ol style="list-style-type: none"> It deals with understanding the molecular aspects of the biology. It majorly emphasizes the concepts of central dogma of molecular biology spanning from DNA Replication till Protein Synthesis and Reverse transcription. It also helps in understanding the concepts of cellular function.
II	HCT-2.2: Microbiology	<ol style="list-style-type: none"> This fundamental paper discusses the importance of microorganisms The course throws light on types of microorganisms in and around humans At the end of the course, the student has understanding on the metabolism and mechanism of microbial life
II	HCT-2.3: Immunology	<ol style="list-style-type: none"> This course gives an overview on the immune system including organs, cells and receptors The students learns about molecular basis of antigen recognition, hypersensitivity reaction, antigen-antibody reactions The course develops in the student an appreciation for principles of immunology and its applications in treating human diseases
II	SCT-2.4: a. Research Methodology Bioethics and IPR	<ol style="list-style-type: none"> The outline of the course is to introduce the students to research methodology, precision and accuracy, cohort studies and quality control. <ul style="list-style-type: none"> At the end of the course the students will be able to apply their learning to design experiments meeting the international guidelines
II	SCT-2.4: b. Enzymology	<ol style="list-style-type: none"> It helps the students to learn the significant features of the biochemical catalysts. It helps the students to learn the methodology involved in assessing the enzyme activity and mechanism of enzyme action. It illustrates the enzyme catalysis, kinetics and regulatory aspects.
II	SCT-2.4: c. Biotechnology and human welfare	<ol style="list-style-type: none"> Types of Biotechnology, Steps in any biotechnological process Introduction to Biotechnology Protein engineering; enzyme and polysaccharide synthesis, activity and secretion, alcohol and antibiotic formation. development of non-toxic therapeutic agents, recombinant live vaccines, gene therapy, diagnostics, monoclonal in E.coli, human genome project.
II	HCP-2.1: Molecular Biology	<ol style="list-style-type: none"> Describe the evolution, diversity and replication of cells The objective of this laboratory course is to provide the students practical skills in basic molecular biology and microbial bioresources.
II	HCP-2.2: Microbiology	<ol style="list-style-type: none"> Students will gain knowledge about the different cell organelles of microorganisms and their

		<p>detailed functions.</p> <ol style="list-style-type: none"> Students will also study the growth and control of microbes as well as different bacteriological techniques involved in microbiology.
II	HCP-2.3: Immunology	<ol style="list-style-type: none"> laboratory testing and clinical consultation in several broad areas including the evaluation of autoimmune disease, immunodeficiencies, immunoproliferative disorders, and allergy, as well as having responsibility for some aspects of infectious disease serology.
II	SCT-2.4: a. Research Methodology Bioethics and IPR	<ol style="list-style-type: none"> Explain and apply techniques for scientific writing and research methodology to prepare the writing of a scientific report. perform investigation using methods, explain and take position on the results as well as summarize related work Apply the knowledge in scientific writing and research methodology and use the knowledge to write a scientific report.
III	HCT-3.1: Genetic Engineering	<ol style="list-style-type: none"> This course is an amalgamation of principles of engineering with genetics. The students learn techniques in separation, gene construction, and gene therapy. By the end of the course, the student would be able to demonstrate the role of genetic engineering in gene therapy and its applications in agriculture and medicine
III	HCT-3.2: Plant Biotechnology	<ol style="list-style-type: none"> Acquire the knowledge about the techniques of Plant Tissue Culture, Lab. organization & measures adopted for aseptic manipulation and nutritional requirements of cultured tissues. Learn the techniques of culturing tissues, single cells, protoplasts & anther culture, germplasm conservation and cryobiology Learn the large scale clonal propagation of plants through various micropropagation techniques, Production of secondary metabolites under in vitro conditions A good understanding of r-DNA technology, methods of gene transfer, molecular markers and marker assisted selection Develop transgenics resistant to biotic & abiotic stresses & quality characteristics and their role in crop improvement.
III	SCT-3.3: a. Animal Biotechnology	<ol style="list-style-type: none"> Understand the fundamental scientific principles that underlie cell culture Acquire knowledge for isolation, maintenance and growth of cells. Develop proficiency in establishing and maintaining of cell lines. 4. Acquire knowledge in animal cloning and its applications.
III	SCT-3.3: b. Phytopharmac ology	<ol style="list-style-type: none"> On completion of this course, students would be able to understand basics of drug discovery and development which would enable them able to apply knowledge gained in respective fields of pharmaceutical industry.
III	SCT-3.3: c. NanoBiotechn ology	<ol style="list-style-type: none"> Students will acquire knowledge on the basic concepts of biological nanomaterials and their utility in health, agriculture and environment.
III	HCP-3.1: Genetic Engineering	<ol style="list-style-type: none"> Describe the different methods to clone the DNA. Discuss how recombinant DNA is formed. Explain how Cloning works by using different systems. State the basic features of the gene expression systems.
III	HCP-3.2: Plant Biotechnology	<ol style="list-style-type: none"> Explain the basics of the physiological and molecular processes that occur during plant growth and development and during environmental adaptations.

		<ol style="list-style-type: none"> 1. Understand how biotechnology has been used to develop knowledge of complex processes that occur in the plant. 2. Use basic biotechnological techniques to explore molecular biology of plants. 3. Understand the processes involved in the planning, conduct and execution of plant biotechnology experiments.
III	SCP-3.3: Animal Biotechnology	<ol style="list-style-type: none"> 1. Be able to describe the structure of animal genes and genomes. 2. Be able to describe how genes are expressed and what regulatory mechanisms contribute to control of gene expression. 3. Be able to describe basic principles and techniques in genetic manipulation and genetic engineering. 4. Be able to describe gene transfer technologies for animals and animal cell lines.
III	HCP-3.4: Entrepreneurship and Startup Studies *	<ol style="list-style-type: none"> 1. Graduates will demonstrate an ability to engage in critical thinking by analyzing situations and constructing and selecting viable solutions to solve problems.
IV	HCT-4.1: Medical Biotechnology and Clinical Research	<ol style="list-style-type: none"> 1. Hands-on training and mandatory research projects will help our students by providing knowledge and technical experience of problem-solving in a research environment. 2. Students after completing this course can become entrepreneurs in the most demanding sector of medical biotechnology such as diagnostics, drug designing, stem cell biology etc. 3. Students will develop an ability to identify, organize and answer problems in Medical Biotechnology 4. Students will develop an ability to use skills and modern technological tools necessary for medical biotechnological practice. 5. Perform independent as well as team work to accomplish lab based tasks. 6. Become a part of mission-Skill India- to develop researcher and scientists to uncover advance biology problems.
IV	SCT-4.2: a. Industrial Biotechnology	<ol style="list-style-type: none"> 1. The course aims to provide fundamental insights to exploit microbes for manufacturing of products which have huge industrial significance. 2. The course blends science and engineering with various biochemical processes to obtain products such as food, chemicals, vaccines, medicine. 3. At the end of the course, the student will have a better appreciation for the role of biotechnology in industry using microbes.
IV	SCT-4.2: b. Vaccine Technology	<ol style="list-style-type: none"> 1. Aware of the strategies available for developing an innovative vaccine technology with different mode of vaccine delivery. 2. Able to explain the significance of critical antigens, immunogens and adjuvants in developing effective vaccines. 3. Aware of the regulatory issues, guidelines for the management of production of vaccine.
IV	SCT-4.2: c. Food Technology	<ol style="list-style-type: none"> 1. Students in this course will learn about microbes in food, spoilage of food and preservation techniques of food. 2. Through this course, they also learn about microbiology of milk, fermented dairy products, industrially important microorganisms and process of industrial production of alcohol, beer, wine, SEP and mushrooms.

		<ol style="list-style-type: none"> 1. At the end of the course, the student will be able to use the preservation techniques for food and use this experience to be employed as quality control experts
IV	HCPW-4.3: Project work*	<ol style="list-style-type: none"> 1. The aim of the project is to test the independent research skills students have acquired during their time at university, with the assessment used to help determine their final grade.
IV	HCP-4.1: Medical Biotechnology and Clinical Research	<ol style="list-style-type: none"> 1. To provide the detailed knowledge of key concepts are applied in areas of specific relevance to medical and pharmaceutical applications. 2. To develop the practical laboratory skills with various opportunities for hands-on experience in a range of current techniques and practices such as mammalian cell culture and fermentation.
IV	SCP-4.2. Industrial Biotechnology	<ol style="list-style-type: none"> 1. Describe the main steps and processes used to produce biological products in industry, 2. Discover new useful microorganisms and store them reliably for later use. 3. Evaluate which molecular techniques are applicable to improve production.