

# DEPARTMENT OF BIOTECHNOLOGY

## KAKTIYA UNIVERSITY, WARANGAL

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### Courses offered by the Department:

- M.Sc. Biotechnology
- 5 Year Integrated M.Sc. Biotechnology
- Ph.D. Programme in Biotechnology

**M.Sc. Biotechnology:** Students are selected through entrance test (KUCET) conducted by Kakatiya University. Two categories of seats are available – Free and Self Finance.

**NRI Students:** NRI students can be admitted directly without any entrance test based on their basic qualification.

**Year Integrated M.Sc. Biotechnology:** This programme is sanctioned by Andhra Pradesh State Counsel of Higher Education (APSCHE), Government of Andhra Pradesh and it is introduced from the academic year(2008-2009) with an intake of 30 seats and the students are selected through entrance test (KUCET).

**Ph.D. Programme in Biotechnology:** Ph.D. Students are selected through eligibility test conducted by Kakatiya University

### Course Objectives

- To Create Intelligent and Skilled Human Resource to Cope up with the Development of Science and Industry.
- To train students to understand about different biomolecules, their structure and function.
- To acquaint the students with the chemistry of biological systems and to unravel the chemistry of the living state.
- To Develop Student Force to enter into Modern Research and Technology.

### The students are trained in the following areas:

- General Biology, Cell Biology and Microbiology
- Basic and Molecular Genetics
- Immunology
- Biochemistry
- Biophysical and Chemical Methods and Bioprocess Technology
- Cell and Tissue Culture Technology
- Molecular Biology and Recombinant-DNA Technology
- Microbial Biotechnology
- Environmental Biotechnology
- Basic and Advance- Plant, Agriculture, Animal and Medical Biotechnology
- Biostatistics and Computer Applications
- Bioinformatics

## Outcomes:

### M.Sc Biotechnology:

#### Programme outcome:

- ❖ M.Sc Biotechnology course is to produce competent skilled man power who can implement their knowledge in the various fields science such as agriculture, industry, healthcare and environment to provide sustainable solution that will benefit human being. Students will exhibit contemporary knowledge in Biotechnology and will be eligible for doing jobs in various sectors of pharmaceutical and biotechnological industry
- ❖ Students will be provided hands on learning into the functioning of the biotechnology industry. Students will have to undertake an Industry Project in their second year of the programme.

#### Programme Specific Outcomes:

- The course curriculum is designed to strengthen the fundamentals in basic subjects and provide hands on practice in all the disciplines of biotechnology.
- Fundamental multidisciplinary knowledge will enable students to design, conduct experiment, analyze and interpret data for investigating problems in Biotechnology and allied fields.
- The Programme inculcates critical thinking and analytical skills, which increases their marketability. Industrial project/Internships give a strong exposure to real time research problems in life science and enable the graduates to launch them in their workplace environment
- Students can opt for higher studies for Ph.D. in India and Abroad. Students can appear for CSIR-NET, GATE, ICMR, DBT examination for getting fellowships for doing research. Students can become entrepreneur and can start consultancy in the field of life science. Several career opportunities are also available for biotechnology students in Abroad.
- Students will gain in-depth knowledge in the domains of Cell biology, Microbiology, Biochemistry, Genetics, Molecular biology, Genetic engineering and Bioinformatics. Students will also obtain hands on training in laboratory techniques related to biophysics, clinical biochemistry, microbiology, molecular biology, bioinformatics, immunology, plant and animal tissue culture.
- This course will develop effective communication, managerial and other skills in students to carry out advanced projects and collaborations even across the disciplines.

#### Course Outcomes

Paper Code	Course/Paper Title	Course outcome
101	Biochemistry	Students will be imparted knowledge about structure and function of different biomolecules (proteins, lipids, nucleic acids, and carbohydrates). Understanding of carbohydrate, protein, lipid, purine and pyrimidine biosynthesis and metabolism.

102	<b>Microbiology and Biodiversity</b>	<p>This course will help students to acquire skills and competency in microbiological laboratory practices applicable to microbiological research or clinical methods, including accurately reporting observations and analysis, applications of Microorganisms in various fields.</p> <p>To study various aspects of biodiversity. To understand global biodiversity (plant and animal) and the concept of Bioprospecting, biosafety, biopiracy and biodiversity conservation.</p>
103	<b>Cell Biology and Genetics</b>	<p>To gain the knowledge of living cells such as prokaryotic and eukaryotic cells.</p> <p>To understand the molecular aspects of Cell Signaling, Protein sorting Cell Cycle and Cell Division Cell Death Pathways. To understand the basics of cancer biology.</p> <p>To understand basic principles and exceptions of Mendelian inheritance. To learn the concepts of Linkage, crossing over and recombination. To gain knowledge about the organelle inheritance. To make students understand the role of the X and Y chromosomes in determining sex and how they are inherited. To impart knowledge about DNA damage and Repair mechanism.</p>
104	<b>Biophysical and Biochemical Techniques</b>	<p>To understand the safety measures in laboratory, handling and care of instruments and demonstrate a broad understanding of life science technologies. To demonstrate ability to plan and execute experiments, and analyze and interpret outcomes. Demonstrate understanding of selected Basic Principles &amp; Concepts about biological techniques like microscopy, centrifugation, electrophoresis, chromatography and basics of radioactivity.</p>
201	<b>Enzymology and Plant Biochemistry</b>	<p>To understand the Mechanisms of enzyme action and Enzymes kinetics.. To study the Regulation of enzyme activity mechanism of some important enzymes. To know the Photosynthetic pigments and photosynthesis in bacteria and higher plants. To study the CO<sub>2</sub> fixation by C<sub>3</sub>, C<sub>4</sub>, and CAM pathways and photorespiration. Students will also be imparted knowledge about nitrogen fixation and <i>nif</i> and <i>nod</i> genes.</p>
202	<b>Immunology and Immunotechnology</b>	<p>To introduce the basic concepts of cells and organs of the immune system and immunity. To study the structure and function of antigen and antibodies. Study of rearrangement of Ig genes. To learn about Major Histocompatibility Complex, antigen processing and presentation, complement system and cytokines. To provide knowledge about Humoral and Cell Mediated Immune Response: B- cell and T – cell receptor complex. Cell mediated cytotoxicity: T cytotoxic cells, Natural Killer (NK) Cells, Antibody dependent cell cytotoxicity (ADCC). To give an overview of hypersensitivity and autoimmunity. Transplantation: Graft vs. host reaction and rejection; Immunization and</p>

		Vaccines. To provide knowledge of antigen-antibody interaction and Immunodiagnostic techniques: RIA and ELISA.
<b>203</b>	<b>Molecular Biology</b>	To understand the concepts of Molecular Biology. To study the chemical & physical properties of nucleic acids. Learn experimental evidences for nucleic acid as carrier of genetic information. To understand DNA replication, transcription, translation in Prokaryotes and Eukaryotes. To study the basic features of genetic code. To understand the regulation of gene expression in Prokaryotes and Eukaryotes.
<b>204</b>	<b>Biostatistics and computer applications</b>	This course will help students' tools of biostatistics in interpretation of biological data. Students will be able to characterize data and understand different sampling methods. To understand the concept of mean, mode, median, range, mean deviation, standard deviation, standard error, correlation & regression, chi square test, t-test. Students will learn about Fundamentals of Computers and Applications of Computers in Biology
<b>301</b>	<b>Plant Biotechnology</b>	Develop skills for application of plant tissue culture techniques. To get the knowledge about the genetic transformation and production of transgenic plants.
<b>302</b>	<b>r DNA Technology</b>	Learning outcomes of this course are technical know-how on versatile techniques in recombinant DNA technology, application of genetic engineering techniques in basic and applied experimental biology and proficiency in designing and conducting experiments involving genetic manipulation. Development of an ability to design and conduct genetic engineering experiments, as well as to analyze and interpret data and construction of DNA and cDNA libraries. Development of research aptitude and technical skills to secure a job in genetic engineering labs. Understand genome complexity, genome organization and genome analysis. Learn Whole genome Sequencing, accessing whole genome sequence databases. Learn the procedures involved in PCR and southern hybridization, etc.
<b>303 Elective</b>	<b>a). Microbial Biotechnology</b>	The course will provide technical knowledge applications of industrial microorganisms. The course will also provide the technical knowledge of several industrial products such as amino acids, organic acids, industrial enzymes and beverages. To gain the knowledge about the role of microbes in food industry.
	<b>b). Advanced Biotechnology</b>	Students will be able to understand the mechanism of Site specific recombination and Advances in transgenic strategies for gene inhibition. The course will provide technical knowledge and applications of ribozyme technology, gene silencing and RNAi technology, genome editing using CRISPR Cas

		Students will the knowledge about host parasite interaction and genome mapping such as Fluorescent in situ hybridization (FISH) and Sequence tagged site (STS) mapping,
<b>304 Elective</b>	<b>a). Medical Biotechnology</b>	Development of solid foundation and requisite research aptitude for further higher studies on regenerative medicines. Become competent to secure a job in biopharmaceutical and biomedical industry. Students will be able to understand the classification of genetic diseases, disease diagnosis and drug delivery & designs This course will help the students to acquire skills and competency in Prenatal diagnosis, gene therapy and Animal Cloning
	<b>b). Nanotechnology</b>	To know the preparation and characterization of appropriate nano materials with precision conceptualize the insertion of nano size in the relevant field of interest
<b>401</b>	<b>Agricultural Biotechnology</b>	Engineering plants for biotic stress like insect and fungal diseases. Engineering plants for abiotic stress like drought and herbicide tolerance. Engineering plants for shelf life and nutritional quality. Gaining knowledge on biosafety, risk assessment and regulation of transgenic plants in India Understand the historical background, importance and levels of Biosafety at laboratory and industrial scale. Understanding of the relationship between society and science and the justification for biotechnological manipulation of plants, animals, and microorganisms.
<b>402</b>	<b>Animal Biotechnology</b>	To know the basics of animal cell culture and apply the knowledge in the relevant field of interest. Pursuing research related to animal cell and tissue culture at national and international level. To contribute in industries related to animal cell culture as scientists
<b>403 Elective</b>	<b>a). Environmental Biotechnology</b>	Explain the importance of microbial diversity and of molecular approaches in environmental microbiology. Describe existing and emerging technologies that are important in the area of environmental biotechnology; Describe biotechnological solutions to address environmental issues including pollution, mineral resource winning, renewable energy and water recycling. Learning outcome of Environment Biotechnology is to gain the knowledge of biodiversity, bioremediation, pollution.
	<b>b). Bioprocess Technology</b>	Plan a research career or to work in the biotechnology industry with strong foundation about bioreactor design and scale-up. Students will be able to explain the steps involved in the production of bioproducts and methods to improve modern biotechnology and can apply basic biotechnological principles, methods and models to solve

		<p>biotechnological tasks.</p> <p>Graduates gain ability to investigate, design and conduct experiments, analyze and interpret data, and apply the laboratory skills to solve complex bioprocess engineering problems.</p> <p>Able to separate the molecules through chromatography and understand the complexity in scale up of unit operations.</p> <p>Able to choose the downstream steps within the constraints of biosafety and process economics</p>
<b>404 Elective</b>	<b>a). Bioinformatics</b>	<p>Students will be able to analyze, interpret and study biological data (sequence, structure, etc) stored in various databases available on internet.</p> <p>Using existing software effectively to extract information from large databases and to use this information in computer modeling.</p>
	<b>b).Pharmaceutical biotechnology</b>	<p>The course will provide technical knowledge of characterization and screening of pharmaceutically important plant secondary metabolites.</p> <p>Students will be able to understand the working and applications of biosensors in Pharmaceutical industries and also drug discovery, design and development</p>
	<b>Industrial Project</b>	<p>In this course, the student will undergo training in any biotechnology industry/institute for 30-45 days during summer vacation after first year This will not only enhance knowledge base of students but also provide them exposure as to how to conduct and carry out a research based task. Students will also learn how to compile and interpret results.</p>

#### **Ph.D. Programme in Biotechnology**

##### **Programme outcome:**

Students will be able to identify societal problems and recognize the importance of designing scientifically sound and ethical research to solve societal problems. Research scholar will become into a good academician and author of necessary papers. At end, research scholars will be awarded with Ph.D and they will be more suitable for higher education and industry needs.

##### **Programme Specific Outcomes:**

- ◆ Acquire in-depth knowledge in the basic concepts of biotechnology to strengthen background for academic, research, industrial and pharmaceutical applications.
- ◆ Recognise the need for the preparation and ability to carry out independent research in broadest context of biotechnological relevance.
- ◆ Analyse and interpret the data using modern tools in biotechnology and effectively communicate the results to the stakeholders