

RAJIV GANDHI INSTITUTE OF IT AND BIOTECHNOLOGY

PO/PSO/CO

Programme outcome of B.Sc. biotechnology is to produce graduate with sound knowledge with hands on experience in the field of life science. So that they are well prepared for the PG courses and technical jobs.

PSO

- The objective of the Biotechnology is to equip the students to apply knowledge of molecular mechanisms of cellular processes in living systems including microbes, plants, and higher order organisms to applied aspects.
- Basics and current updates in the areas of Industrial Biotechnology, Fermentation Technology, Agriculture & Environmental Biotechnology are included to train the students and also sensitize them to scope for research
- To produce students who attain professional leadership role.
- To impart an ability to apply biotechnology skills (including molecular & micro biology, immunology & genetic engineering, bioprocess & fermentation, enzyme & food technology and bioinformatics) and its applications in core and allied fields.
- To provide students with the concepts and research approaches for their higher career in the field of biotechnology and develop their scientific interest.
- To impart in-depth practical oriented knowledge to students in various thrust areas of biotechnology, so as to meet the demands of industry and academia.

Course Outcome: UG

Biochemistry: Students understand the Basic Structure and metabolism of Biomolecule

Cell biology: To make the student to understand the concept of cell and their activities.

Microbiology: The student should have understood the microorganisms, their role in diseases and their applications in various fields

Immunology: Concepts of Antigen Antibodies, Techniques involved in study of antigen antibody complex. Autoimmune diseases.

Molecular biology: Students will gain the knowledge of DNA, RNA, Central Dogma, Transcription and Translation.

Genetics: understand the concept of genes and their behavior

rDNA Technology: Student knowledge of Manipulation of genes, Transfer techniques, Expression systems and methods of selection

Food biotechnology: Student will understand the role of biotechnology in food industry, Preservation and processing of food.

Plant biotechnology Animal biotechnology: Gain knowledge of Crop development, Callus culture, Biotechnological applications of plants, Animal tissue culture, Animal products, production.

Environmental biotechnology, Understand Ecosystem, energy flow and Uses and values of Biodiversity

Biostatistics and Bioinformatics: Statistical Analysis of biological data and their interpretation by using soft wares.

M.Sc. Biotechnology

Programme outcome M.Sc Biotechnology 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 be eligible for doing jobs in various sectors of life sciences.

PSO

Upon completion of the M. Sc Biotechnology programme, the candidate should be able to:

- Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.
- Develop an ability to solve, analyze and interpret data generated from experiments done in project work or practical courses.
- Demonstrate skills to use modern analytical tools/ software/ equipments and analyze and solve problems in various courses of biotechnology.
- 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 behaviors in decision making.
- Apply written and oral communication skills to communicate effectively in healthcare, industry, academia and research.
- Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.
- Develop skills, attitude and values required for self-directed, lifelong learning and professional development

Course Outcome:

M.Sc. Biotechnology / Cell Biology and Developmental Biology : To gain the knowledge of living cells such as prokaryotic and eukaryotic cells, formation of cells, cell adhesion and cellular signaling, role of cell division and its regulation on diseases like cancer

Biochemistry: Students will be imparted knowledge about structure and function of different biomolecules (proteins, lipids, nucleic acids, and carbohydrates), synthesis and metabolism of biomolecules.

Microbiology: 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.

Microbial Technology: The course will provide technical knowledge applications of Microorganisms in bioprocess industry, fermentation, downstream processing

Immunology: The course will provide technical knowledge of immune system deals with various pathogens, different processes and cell types involved in autoimmune disease.

Biostatistics 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.

Bioinformatics tools and techniques of bioinformatics can be utilized in studies pertaining to macromolecules (DNA, RNA, protein). Structure and organization of genomics and proteomics. Students will be able to analyze, interpret and study biological data (sequence, structure, etc) stored in various databases available on internet.

Genetic engineering : 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.

Molecular Biology: Students will gain indepth knowledge of DNA, RNA, Central Dogma, Transcription and Translation

Plant Biotechnology Animal Biotechnology: Gain knowledge of Crop development, Callus culture, Biotechnological applications of plants, Animal tissue culture, Animal products, production

Research Methodology: Course on research methodology will provide knowledge base as to how to design a research project and about different aspects involved in carrying out research. Students will learn the methods of sampling, reviewing a research objective, conducting experiments and interpretation of results.

Environmental Biotech: Learning outcome of Environment Biotechnology is to gain the knowledge of biodiversity, bioremediation, pollution.

Dissertation: This course will include allotment of an individual research work to each student to be carried out in fourth semester. 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.

M.Sc. Medical Biotechnology

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.

M.Sc. Medical Biotechnology

PSO:

- Demonstrate knowledge for in-depth analytical and critical thinking to identify, formulate and solve the issues related to Biotechnology Industry, Pharma industry, Medical or hospital related organizations, Regulatory Agencies, & Academia.
- Develop an ability to solve, analyze and interpret data generated from experiments done in project work or practical courses.
- Demonstrate skills to use modern analytical tools/ software/ equipments and analyze and solve problems in various courses of biotechnology.
- 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 behaviors in decision making.
- Apply written and oral communication skills to communicate effectively in healthcare, industry, academia and research.
- Apply responsibilities to promote societal health and safety, upholding the trust given to the profession by the society.
- Develop skills, attitude and values required for self-directed, lifelong learning and professional development

Course Outcome:

Cell Biology and Developmental Biology : To gain the knowledge of living cells such as prokaryotic and eukaryotic cells, formation of cells, cell adhesion and cellular signaling, role of cell division and its regulation on diseases like cancer

Biochemistry: Students will be imparted knowledge about structure and function of different biomolecules (proteins, lipids, nucleic acids, and carbohydrates), synthesis and metabolism of biomolecules.

Microbiology: 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.

Microbial Technology: The course will provide technical knowledge applications of Microorganisms in bioprocess industry, fermentation, downstream processing

Immunology: The course will provide technical knowledge of immune system deals with various pathogens, different processes and cell types involved in autoimmune disease.

Bioinformatics tools and techniques of bioinformatics can be utilized in studies pertaining to macromolecules (DNA, RNA, protein). Structure and organization of genomics and proteomics. Students will be able to analyze, interpret and study biological data (sequence, structure, etc) stored in various databases available on internet.

Genetic engineering : 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.

Molecular Biology: Students will gain indepth knowledge of DNA, RNA, Central Dogma, Transcription and Translation

Stem cell biology: Theoretical knowledge of various topics as per the syllabus including basic cell culture techniques; Primary culture, secondary culture; Continuous cell lines; Suspension cultures; Transfection, pluripotency, stem cells. Concept building in animal reproductive biology, Animal genomics and DNA forensics: Embryo transfer; Micromanipulation of animal embryos; Transgenic animal technology

Human Physiology: To provide a course of study in mammalian, systems physiology, building on knowledge of basic physiological principles

Research Methodology: Course on research methodology will provide knowledge base as to how to design a research project and about different aspects involved in carrying out research. Students will learn the methods of sampling, reviewing a research objective, conducting experiments and interpretation of results.

Dissertation: This course will include allotment of an individual research work to each student to be carried out in fourth semester. 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.

Program Specific Outcomes: M.Sc. Bioinformatics and A.D.B

21st century biology has been transformed into integrative biology due to paradigm shift from reductionist to holistic approach. The data explosion is one of the obvious causes of the transformation to holistic or systems biology mode. In order to have deeper insights in to biological systems, integration of the data from genome to phenome levels to generate dynamic models has surfaced as key area of bioinformatics.

A student completing a major in Bioinformatics (M.Sc. Bioinformatics) shall be able to apply:

- Design computational biology experiments, conduct experiments, analyze and interpret data for all biological fields including medicine and pharmacy.
- knowledge and awareness of the basic principles and concepts of biology analyze and interpret data for life sciences, computer science and mathematics
- existing software effectively to extract information from large databases and to use this information in computer modeling
- problem-solving skills, including the ability to develop new algorithms and analysis methods
- an understanding of the intersection of life and information sciences, the core of shared concepts, language and skills the ability to speak the language of structure-function relationships, information theory, gene expression, and database queries
- Design algorithms, Architecture work flow, data analysis software, pipeline of the work flow.
- Software testing
- 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 computational biology, NGS, Machine learning approach, AI implementation.

A student completing a post graduate Diploma in Bioinformatics (ADB) shall be able:

- To impart deep knowledge of the discipline
- Develop skills in relevant areas to enhance employment opportunities
- Introduce emerging areas of NGS, Drug designing and data mining through machine learning, current trends in bioinformatics
- Build interdisciplinary approach
- Foster global competence among students
- Inculcate social and moral values and sense of scientific responsibilities in students
- To apply for MS courses in very reputed universities at abroad.

Course Outcome: PG and Diploma course

Cell Biology (C): To gain the knowledge of living cells such as prokaryotic and eukaryotic cells, formation of cells, cell adhesion and cellular signaling, role of cell division and its regulation on diseases like cancer

Biochemistry (C) : Students will be imparted knowledge about structure and function of different biomolecules (proteins, lipids, nucleic acids, and carbohydrates), synthesis and metabolism of biomolecules.

Biomathematics (C): They may be employed as statisticians, scientific programmers, or in areas of bio-science where training in quantitative techniques is needed. Further, they are equipped to pursue graduate studies in theoretical biology, physiology, biostatistics, statistics, and areas of applied mathematics.

Biostatistics (C): The subject and its relation with the other sciences, restate the principal concepts about biostatistics. Collect data relating to variable/variables which will be examined and calculate descriptive statistics from these data. Identify data relating to variable/variables.

C Programming and Data structure (C):

PERL Programming /HTML Programming:

Learning a new language introduces learners to diverse cultures and a range of ways of expression and communication with other speakers of the foreign language in a variety of contexts. It also enhances literacy development in both the official language(s) and the foreign language.

Biological Informatics (C): Knowledge and Awareness of the Basic Principles and Concepts of Biology, Computer Science and Mathematics.

Existing Software Effectively To Extract Information from Large Databases and to Use This Information In Computer Modeling.

DBMS & MongoDB (C):

DBMS: Designs SQL queries to add data to the database, edit existing data, and to delete data from the database. Declares and enforces integrity constraints on a database. Understands and applies indexing mechanisms in databases. Will be able to describe and develop Relational Algebra and Relational Calculus queries.

MongoDB: The Easiest Way to Deploy, Operate, and Scale MongoDB in the Cloud in Just a Few Clicks. Create Deployments in Minutes w/ MongoDB Atlas. Speeding Progress. Reducing TCO. Streamlines Operations. Types: Avail. on AWS, GCP, Azure, Zero-downtime migration.

Statistical Analysis System (SAS) (C):

Creating new knowledge (Cognitive)

Developing feelings and emotions (Affective)

Enhancing physical and manual skills (Psychomotor)

Learning objectives can also be scaffolded so that they continue to push student learning to new levels in any of these three categories.

R and Data Analytics (C)

Master the use of the R and RStudio interactive environment.

Expand R by installing R packages.

Explore and understand how to use the R documentation.

Read Structured Data into R from various sources.

Understand the different data types in R.

Understand the different data structures in R.

Proactivity & Anticipating Needs: ...

Mitigating Risk & Fraud: ...

Delivering Relevant Products: ...

Personalisation & Service: ...

Optimizing & Improving the Customer Experience.

JAVA and BioJAVA Programming (C): On completion of the course the student should be able to: Use an integrated development environment to write, compile, run, and test simple object-oriented Java programs. Read and make elementary modifications to Java programs that solve real-world problems.

Science of Omics (C)

Students will be able to critically discuss and solve problems relating to:

- The ways in which investigations of the four 'omics' realms (genome, transcriptome, proteome and metabolome) are tackled analytically;
- The statistical approaches and workflow practices involved in genomics and in a range of transcriptomic approaches;
- The ways in which protein functions can be understood in terms of their structures, and the relative advantages of different analytical approaches in protein structure determination;
- The relationship between the proteome and other 'omics' domains, and the ways in which the proteome can be investigated using a variety of technological approaches;
- The source and variety of components of the metabolome and of their relationship with entities in the other 'omics' domains, and the ways in which the metabolome can be investigated using a variety of technological and statistical approaches;
- The ways in which biological systems can be understood at a systems or network level, and the ways in which models can be constructed and analyses performed to draw biological inferences about the interactions between different parts of a network.
- Use computers creatively to manipulate omics-level datasets and protein structure files;

- Use computer programs to execute a variety of planned analyses in several areas relating to omics domains and to protein structure;
- Critically evaluate and synthesise the results of omics-level analyses to draw biological inferences.

Proteomics (C): The students will have an introduction to current methodologies and trends in the field of proteomics. The students should also obtain an overview and awareness of typical proteomics applications both from lectures and an introduction to proteomics lab work.

After completed course the student should be able to describe and discuss the possibilities and advantages, and the complexity and drawbacks of various proteomics technologies compare traditional methods with emerging technologies. The student should be able to suggest suitable approaches for specified applications and motivate the choice speculate and argue about the future of proteomics technologies. With the acquired knowledge, the students should be able participate in scientific discussions regarding proteomics technologies critically evaluate scientific results.

Molecular Biology: Students will gain the knowledge of DNA, RNA, Central Dogma, Transcription and Translation

Recombinant DNA Technology: 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.

Structural Biology and Molecular Modeling: Students learn the basics of mathematical modeling and computer biomolecular systems, dynamics and simulation of selected regulatory processes using the methods of mechanic and molecular dynamics, Monte-Carlo methods, molecular models, and the basics of systems theory. Students become familiar with well-known and popular molecular modeling and design packages as well as the virtual reality technology. The lecture and exercises prepare students for independent modeling of biomolecular systems and designing of enzyme inhibitors – potential drugs.

Scientific Writing Skills: The SV/S course aims developing knowledge and skills in scientific writing from the basic level; therefore there are no requirements for the initial competence. A goal of scientific writing is to communicate scientific information clearly and concisely. Flowery, ambiguous, wordy, and redundant language run counter to the purpose of the writing. It must be set within the context of other published work.

Cheminformatics and Drug Designing: the student should be able to: Have the knowledge of the basic ligand/structure based drug design approaches. Understand the basic algorithms used in the established software to carry out the most common CADD project. Understand the importance of proper use of various parameters in cheminformatics application programs.

Practical use of various computational tools available for computer-aided drug design including 2D/3D structural database.

Machine Learning Techniques:

Develop an appreciation for what is involved in learning models from data.

Understand a wide variety of learning algorithms.

Understand how to evaluate models generated from data.

Current Bioinformatics: The learning objectives of the course is that the student demonstrates the ability to:

- Describe the basic principles for the most common NGS platforms such as Illumina, IonTorrent, Roche 454 and Pacific biosciences
- Explain the advantages and disadvantages with the different NGS platforms and describe which of the platforms would be most optimal to study the genome, epigenome and transcriptome.
- Explain the different steps of Illumina sequencing (DNA library synthesis, DNA sequencing and data analysis).
- Describe different biochemical methods applied to enrich different parts of the genome and transcriptome before sequencing.
- Synthesize and quality control DNA libraries for Illumina sequencing – synthesis, purification and multiplexing.
- Understand and apply different types of quality control methods before, during and after Illumina DNA library synthesis.
- Understand the output data files from Illumina sequencing and be able to perform the most basic NGS analysis (demultiplexing, genome alignment and DNA quantification).
- Use different types of NGS analysis tools.

Python Programming: Python programming is intended for software engineers, system analysts, program managers and user support personnel who wish to learn the Python programming language. Learning Outcomes: Problem solving and programming capability.

Introduction to Clinical Trials and Pharmacovigilance: At the end of the course students will be able to;

- Explain the regulatory requirements for conducting clinical trial
- Describe in detail about various types of clinical trial designs
- Explain the responsibilities of key players involved in clinical trials
- Describe the documentational requirements for Clinical trials
- Explain Adverse drug reaction and its management
- Describe basic concepts, and establishment of Pharmacovigilance

- Explain ADR reporting, methods and tools used in Pharmacovigilance
- Describe Pharmacoepidemiology, pharmacoconomics and safety pharmacology

Selenium:

- Define Application and understand different types of Applications.
- Define Testing and know the different types of Testing.
- Describe Manual Testing.
- Describe Automation Testing: Test Automation, ROI in automation & Framework.

Cancer Genomics:

- Understand basic aspects of cancer pathology. What is cancer? Understand chromatin as it relates to gene expression.
- Understand epigenetics and somatic genetic changes in tumors.
- Understand modern aspects of RNA and protein biology.
- Understand the cell cycle, angiogenesis and apoptosis.
- Be familiar with basic facets of carcinogenesis and methods to study the process. Be familiar with basic principles and applications of cell culture and animal models to study cancer.
- Understand how genetics contributes to predisposition and progression of cancer.
- Understand the differences and overlap of cancers by tissue type.
- Understand how immunotherapy is, and can be, used to treat human illness: strategies, advantages, and hurdles to overcome to realize its potential.

Biodiversity Informatics & Molecular Phylogenetics:

- Biological Nomenclature & Species Description
- Practical Aspects of Phylogenetic Data Collection & Analysis
- The role of Phylogenetic Biology in Biological Problem Solving
- A Survey of the History of Life on Earth
- Principles of Bioinventory, Biodiversity Conservation

System Biology: Understand the basics of Systems Biology approaches in biological systems; apply systems approaches to the analysis of biological systems; apply model driven experimentation to solve biological questions; analyze biological systems in a systems-wide manner.

Artificial Intelligence: Students will be familiar with AI and its applications in biology.



S. Shinde
PRINCIPAL
 Bharati Vidyapeeth
 (Deemed to be University)
 Rajiv Gandhi Institute of I.T. & B.T.
 Pune Satara Road, Pune - 411 046.