

`G.E. Society's

RNC ARTS, JDB COMMERCE & NSC SCIENCE COLLEGE, NASHIK-ROAD

Department of Biotechnology

Programme Outcomes: B. Sc. Biotechnology

Programme Outcomes	<p>PO-1: B.Sc. Biotechnology programme is meant to give students a thorough understanding of the fundamentals of Biotechnology, including all its principles and perspectives.</p> <p>PO-2: Various branches of Biotechnology such as Chemistry, Physics, Biochemistry, Biophysics, Animal and Plant Science, Microbiology, Biomathematics and Biostatistics, Computers, Cell Biology, Molecular Biology, Metabolism, Environmental Biotechnology, Bioanalytical techniques, Immunology, Animal and Plant Development, Microbila Biotechnology, Industrial Biotechnology, Recombinant DNA Technology, Applied Biotechnology, Plant and Animal Tissue Culture, Biodiversity and systematics, Enzyme and Enzyme technology, Agricultural Biotechnology, Food and Pharmaceutical, bioinformatics, Bioethics & Bioethic, and IPR expose the various aspects of Biotechnology where the Students gain a broader understanding of the subject.</p> <p>PO-3: It helps them to Demonstrate, solve and an understanding of major concepts in all disciplines of Biotechnology and society.</p> <p>PO-4: The three year B.Sc. Biotechnology course curricula are separately classified to provide incremental progression.</p>
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	<p>PO-5: The practical activities performed in the laboratories teach students about numerous isolation and estimation techniques.</p>
	<p>PO-6: Knowledge related to Bioinstruments like gel electrophoresis, spectrophotometer, centrifuge, incubator, laminar air hood, COD digester, Muffle furnace, SDS, inverted microscope, shaker incubator, etc</p> <p>PO-5: Programme helps to derive green technology and sustainable development that will help society at large.</p> <p>PO-6: It helps in inculcating the scientific temperament in the students and outside the scientific community.</p> <p>PO-7: It helps in understanding modern techniques, equipment and Kit.</p>
<p>Programme Specific Outcomes</p>	<p>PSO-1: Students will understand the processes of several types of organic, inorganic reactions, Microbial techniques, aseptic transfer technique, Surface tension, viscometer, micrometer screw gauge, vernier caliper, fermentation technique, DNA isolation technique, etc.</p> <p>PSO-2: Students will help to comprehend theoretical knowledge Physics, Biophysics, Chemistry, Biochemistry, Genetics, Immunology, Environment and Biodiversity, Plant and animal development, Plant and animal tissue culture, Genetic engineering, etc.</p> <p>PSO-3: Biotechnology practical classes, help students to learn to estimate Biology samples both qualitatively and quantitatively using conventional methods of analysis.</p> <p>PSO-4: Students will learn how to manufacture Biology products by Fermentation, Plant Tissue Culture and Food Technology under optimal reaction conditions.</p> <p>PSO-5: Learn about different Biodiversity assessment using different indexes (Simpson and Shannon index), species richness, evenness, density, relative abundance through theoretical and practical knowledge.</p> <p>PSO-6: Students will help to comprehend theoretical knowledge Bioethical handling of Biological samples, levels Biosafety for specific microorganism, role of international Bioethical committees.</p> <p>PSO-7: IPR and its legal protection in research, tools of IPR, terminologies of IPR - Patent, copyright, trade mark, trade secret, Indian patent law, etc.</p> <p>PSO-8: Learn about online software (NCBI, EMBL, Hinden Markow Model) handling and analysis for finding sequence similarity, gene bank, and protein bank.</p>

	PSO-9: Recognize safe laboratory methods and procedures.
Course Outcomes B. Sc Biotechnology Semester I (2020-21)	
Course Outcomes	After completion of these courses students should be able to
BBt 101 Fundamentals of Chemistry	CO-1: The students will understand the Qualitative analysis, Quantitative analysis, Rate of the reaction, saponification, models of molecules, Titration reaction and separation techniques .
BBt 102 Fundamental of Physics	CO-1: Students will understand the basic concept of different physical properties like surface tension, viscosity, fluid mechanics, properties of waves, etc CO-2: Students will learn the Principles of Physics which will help them to apply it in other aspects of life.
BBt-103 Biochemistry I	CO-1: Students will understand the chemistry of different Biomolecules like Water, Carbohydrates, and Lipids.
BBt-104 Biophysics	CO-1: Students will learn the basics concept of atomic structure, radioactivity, etc. CO-2: Students will learn basic principles of different techniques.
BBt-105 Animal Sciences I	CO-1: Students will understand the classification of Animal Kingdom. CO-2: Students will learn about histological aspects. CO-3: Students will learn the different model organisms that will help them to use it practically.
BBt-106 Plant Sciences I	CO-1: Students will understand the classification of Plant Kingdom. CO-2: Students will understand modification in the plant kingdom as well as its reproductive system. CO-3: Students will learn about internal organ structure and internal organization of the plant body..
BBt-107 Microbiology I	CO-1: We can apply the knowledge of microbiology to understand the microbial physiology and to identify microorganisms. CO-2: to understand the regulation of biochemical pathways and possible process modification for improved control over microorganisms for microbial product synthesis.

BBt-108 Biomathematics and Biostatistics-I	CO-1: Students will learn Math and Statistics in relation to Biology. CO-2: Students will understand Fundamentals Mathematical Calculations, Matrices, Introduction to Statistics, Descriptive biostatistics, etc correlating with respect to Biology.
Course Outcomes B. Sc Biotech Semester II (2020-21)	
Course Outcomes	
BBt-201 Fundamentals of Chemistry II	CO-1: Students will learn concepts of Ionic equilibria, Chemical kinetics, Electrochemistry, and Basics of mole concept. CO-2: Students will learn theoretical knowledge of acid-base titration, rates of reactions, order of reaction, mole concept, normality, molarity, etc.
BBt-202 Biochemistry II	CO-1: Students will learn concepts of proteins, vitamins, enzymes and nucleic acids. CO-2: Students will learn about Biomolecules and its importances in Biotechnological techniques.
BBt-203 Bioinstrumentation	CO-1: Students will learn theoretical concepts spectroscopy, microscopy, separation techniques, and Bioinstruments. CO-2: Students will understand the Principles of Lamberts and Beer's law, Chromatography, microscopy, pH meter, Centrifuge, mass spectroscopy and Absorption spectroscopy. CO-3: Students will learn principles of thermoregulations, thermocouple, and body temperature regulation.
BBt-204 Animal Sciences II	CO-1: Students will learn concepts of metabolism, digestion, excretion, endocrine system, etc. CO-2: Students will understand the relation between Host and parasite and its symptoms and its treatment. CO-3: Students will learn the economic importance of apiculture, sericulture, vermiculture and aquaculture.
BBt-205 Plant Sciences II	CO-1: Students will understand the process of Permeability, Diffusion & imbibition, Osmosis & its types, osmotic pressure (OP), turgor pressure (TP) and wall pressure (WP) , DPD (Suction pressure), etc. CO-2: Students will understand plant metabolism, Photosynthesis, Nitrogen metabolism, Respiration, etc.

	<p>CO-3: Students will learn Growth and development of plants, Photoperiodism, Vernalisation, etc</p> <p>CO-4: Students will learn Economic importance of Cereals, Pulses, Oil seeds, Fiber plants, Medicinal Plants, Timber yielding, Beverages.</p>
BBt-206 Microbiology II	<p>CO-1: Students will learn how to Cultivate, grow and isolate of microorganisms, Preservation and Maintenance methods.</p> <p>CO-2: Students will learn Sterilization and Disinfection, pasteurization, Autoclave, Chemical Agents and their Mode of Action, Disinfectant, Antibiotics and other chemotherapeutic agents, etc.</p> <p>CO-3: Students will understand Microbial Interactions with Plant and animal</p>
BBt-207 Biomathematics and Biostatics-II	<p>CO-1: Students will learn Homogeneous and non-homogeneous linear equation system, Differentials equations, Homogeneous and non-homogeneous differential equations, etc.</p> <p>CO-2: Students will learn Differential Calculus, Integral Calculus, etc.</p> <p>CO-3: Students will understand Probability and probability distribution, Probability theory experiments, Discrete random variable, binomial distribution and the poisson distribution, Normal distribution and application in biosciences.</p> <p>CO -4: Students will understand Hypothesis testing and correlation, Purpose of hypothesis testing, data, assumptions and hypothesis, significance level, types of errors, etc</p>
BBt-208 Computer in biology	<p>CO-1: Students will learn history of Generations of computers (I, II, III, IV, V) Modern computers: The workstation, The Minicomputer, mainframe Computers, Parallel processing Computer & the Supercomputer, etc.</p> <p>CO- 2: Students will understand Data processing & presentation, Computer viruses, Internet searches, etc.</p>

	CO- 3: Students will learn Databases, E-R Model (Entity and entity sets; Relations and relationship sets; E-R diagrams; Reducing E-R Diagrams to tables), B + Tree indexed files, B Tree indexed files, etc.
Course Outcomes B. Sc Biotech Semester III (2020-21)	
BBt-301 Cell Biology	CO 1- students will understand cell theory basic structure function of cell in multicellular organization CO 2- roles of cell organelles cell death different method to understand the structure of cells
BBt-302 Molecular Biology	CO 1- understanding the central dogma of life nucleic acid organization CO 2- chromosomal organization, genetic code , replication transcription , translation of genes
BBt-303 Genetics	CO-1 Understanding the chemical basis of heredity. CO-2 Understanding how the genetic concepts affect broad social issues including health and disease, food and natural resources, environmental sustainability.
BBt-304 Metabolism	CO-1. It will help to understand role of enzymes which is a very important part of metabolic pathways. CO-2 It will help to understand the metabolism of biomolecules such as Carbohydrates, lipids, amino acids and nucleic acids.
BBt-305 Environmental Biotechnology	CO-1 Students will understand basic concepts of Environmental Biotechnology'. CO-2 Students will understand various types of Ecosystems, their structure and functions. CO-3. They will also understand how the knowledge of Biotechnology is useful in protection of Environment.
BBt-306 Bio analytical Techniques	CO-1 Students will learn the basic concept and principle behind bioanalytical techniques. CO-2 It will help to learn the theoretical part of every technique such as Chromatography, Electrophoresis, Spectrophotometer etc.
EVS- 231 AECC-I Environment science theory paper 1	CO-1 It helps to learn the components of Environment and how to conserve the use of ecosystem, natural resources etc. CO-2 Environment Protection awareness is created.
BBt-403 Immunology	CO1- Study of Immunology help to demonstrate the basic knowledge of immunological processes. CO-2 Outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate. CO-3 Understand and explain the immunological tolerance, autoimmunity and transplantation.

BBt-404 Animal Development	CO-1 Students will understand the basic concept of reproduction and development, gastrulation, blastulation. CO-2 The morphogenetic movements of developing tissue, the effect of maternal genes in pattern formation, stem cells and concept of aging.
BBt-405 Plant Development	
BBt-406 Microbial Biotechnology	CO-1 Apply the knowledge to understand the microbial physiology and to identify micro organism. CO-2 Understand the regulation of biochemical pathways and possible process modifications for improved control over microorganisms for microbial product synthesis.
Course Outcomes B. Sc Biotech Semester V (2020-21)	
BBt-501 Industrial Microbiology	CO-1 students will understand overall industrial fermentation process bioreactor design strain improvement techniques CO 2- it will help to understand media optimization tech and different bioprocess parameters
BBt-502 R- DNA technology	CO-1: Students will understand Introduction to Recombinant DNA Technology, history, basic layout of laboratory. CO-2: Students will understand Molecular tools used in Recombinant DNA Technology such as restrictions enzymes, ligases, etc. CO-3: Students will learn Vectors used in Recombinant DNA Technology like Plasmid, Phagemid, Cosmid, Agrobacterial Vectors – Ti plasmid, etc. CO-4: Students will learn construction of Genomic and cDNA Library, etc. CO -5: Students will learn process PCR, RT PCR, etc CO - 6: Students will learn Sequencing of Genes and Genomes, Sanger’s enzymatic method, Maxam- Gilbert Method, Automated DNA sequencing, etc CO-7: Student will understand Applications of Recombinant DNA Technology like Recombinant

	Biotherapeutics (Insulin production), Gene therapy, introduction to CRISPR/Cas9 as genome editing tool
BBt-503 Plant Tissue Culture	CO-1 it will help to understand basic concept of plant tissue culture ,different techniques basic facilities of present in PTC How to grow plants in bottles without soil in miniaturized scale
BBt-504 Animal Tissue Culture	CO1- students will understand how to grow animal cell lines in artificial media different equipments used in animal tissue culture CO-2 it will help to understand applications of animal tissue culture
BBt-505 Applied biotechnology I	CO-1: Students will understand the Biotechnology in Agriculture Waste Recycling, Waste Management, Biomass Briquetting. CO-2: Students will understand Biotechnology in Diagnosis Molecular Diagnostics, Immunodiagnostic techniques: DNA reporters, fluorogenic reporters, electro-chemiluminescent tags & label free immunoassays, etc. CO-3: Students will learn Marine Biotechnology, it's Significance, Marine derived pharmaceuticals, Marine actinobacterial metabolites & their pharmacological potential, Barophilic organisms & their applications, etc. CO -4: Students will learn the concepts of Nanobiotechnology, Introduction, what is Nanotechnology and Nanobiotechnology, Principles of nanoparticle synthesis using living organisms and characterization,etc.
BBt-506 Biodiversity and Systematics	CO 1- students will understand variety and variability of living organisms and how to calculate biodiversity CO 2- it will help to understand tools of techniques in biosystematics
BBt-507 SEC – I : Summer Industrial Internship / Review writing/ Start up Design or Case study Report	CO-1 students will get opportunity to work in biotech industry It will help to understand different techniques , processes, instruments used in biotech industry CO-2 at the end of the training they will get certificate which will help them in future
BBt-508 SEC – II : Project formulation and presentation	CO 1- students will experience research activity by doing different techniques by their own CO 2- students will explore different ideas and their knowledge for formulation of project

**Course Outcomes B. Sc Biotech
Semester VI (2020-21)**

BBt-601 Enzyme and Enzyme Technology	<p>CO 1- This subject will help to understand overall basics about enzymes</p> <p>CO 2- students will understand enzyme catalysis, kinetics, regulation, immobilization and applications in biosensor</p>
BBt-602 Agriculture Biotechnology	<p>CO 1- it will help to understand how to develop draught and herbicide tolerant varieties traditional and modern agriculture biotechnology</p> <p>CO 2- students will understand how to prepare biopesticides and biofertilizers</p>
BBt-603 Applied Biotechnology II	<p>CO-1: Students will learn Biotechnology in Environment, Generation of plant origin alternate fuels, 1st Generation Biofuels, 2nd Generation Biofuels, 3rd Generation Biofuel, etc.</p> <p>CO -2: Students will have perspective of Biotechnology in Human Welfare, Application to Forensic science, Genetically modified (GM) crops and food, GUARDIAN, etc.</p> <p>CO - 3: Students will learn Systems and Synthetic Biology in Biotechnology.</p> <p>CO -4: Students will learn about Stem Cell technology, etc.</p>
BBt-605 Bioinformatics	<p>CO-1: Students will learn History of Bioinformatics and its relationship with biotechnology.</p> <p>CO-2: Students will have theoretical knowledge about different databases, NCBI, DDBJ, GENBANK and EMBL, etc.</p> <p>CO -3: Students will learn Data Generation Tools like NGS Genome Sequencing, protein sequencing, NMR Spectroscopy, and Microarray, etc.</p> <p>CO -4: Students will understand Retrieval of Data, Classification and Presentation of Data, Quality of data, private and public data sources, file Format (Genbank, DDBJ, FASTA, PDB, SwissProt), introduction to Metadata and search; Indices and Boolean.</p> <p>CO -5: Students will understand sequence Alignments and Visualization, BLAST and FASTA Algorithm, Clustal-W, etc.</p>

	CO -6: Students will learn Protein structure and visualization tools, SPDBV, PyMol etc.
BBt-606 Bio safety and Bioethics and IPR	CO 1-it will help to understand basic principles of bioethics Regulatory bodies CO- 2 students will understand what is IPR ,GMOs , what are biosafety levels and good laboratory prtices
BBt-607 & 608 SEC – III & SEC – IV : Project	CO 1- students will get research ideas and methodology for scientific research CO 2- it will help to understand literature review objectives of this course in organization of research ideas, experiential learning through focused skill building activity