



## Professional Postgraduate Program in Biotechnology (PPGP-BT)

(Autonomous, full-time, 11 months, residential Program  
in association with **ATG Biosystems**)



Biotech industry has made historic progress with strong product pipelines and product successes, record-breaking financing totals, unprecedented deal activity and impressive financial results in the last three years. The global biotech revenues of the public listed companies in 2006 grew to \$73.5 billion, recording a 14 percent growth over that in 2005 (\$64 billion). All the leading regions in the world recorded a strong double-digit growth, with the US and Europe recording 13 percent growth each, and Canada registering 22 percent growth. Biotech industry in India grew by 37% each year since 2004-2005. It reached the target of US \$ 1.50 billion in 2005-2006 and touched 2 billion dollar mark in revenue for 2006-07. It is expected that biotech industry will reach target of US\$ 5.00 billion by 2010 and generate minimum 100,000 jobs.

The major sectors of biotech industry demanding for the expertise and manpower in the area are molecular biology, biomarker technology, recombinant proteins, industrial biotechnology, nanobiotechnology, biotech IPR issues, biotech regulatory affairs, cGMP and clinical research management and biosupply segment.

This Professional Postgraduate Program in Biotechnology addresses above issues and transforms life sciences postgraduates into Biotech Professionals with extremely high potential for job opportunities in R&D labs and in the biotech industry at the national and international level.

## Distinctive Features

- Theory and laboratory sessions to gain experience of practical situations in most modern biotechnology labs
- Expert lectures, seminars and case studies by leading experts from industries and national and international institutes of repute
- Twelve weeks full time project to enhance the understanding of real life scenarios in chosen area of technology
- Collaborations with industries and national and international biotechnology institutes

## Eligibility

Post-Graduates with a Master's Degree in any subject of Life Sciences / Chemistry or Graduates with a degree in Engineering / Technology / Pharmacy (with minimum 50 percent marks or equivalent grades).

## Curriculum

### Basic Courses:

**CS001 / CS002 / CS003 Life Skills Development – I / II / III (Each 20 Hours):** The Life Skills Development Program prepares the participants for communication and interaction in an organizational set-up. The focus would be on grammar, vocabulary, spoken English, remedial English, presentation skills, debates, group discussions, team building, time management, cross-cultural communication, creative and business writing. The objective of this course is to develop individuals with high intelligence and emotional quotients and will be competent in spoken English. At the end of the Life Skills Development Program the participant will be well equipped with language skills, soft skills to enter the challenging corporate world.

### Core Courses:

**BT601 Molecular Biology (80 Hours):** Nucleic Acid Structure and Function. DNA Replication, Transcription, Translation. Chromosome Structure and Remodeling. Regulation of Gene Expression in Prokaryotes and Eukaryotes. Recombinant DNA technology. Microarrays. RNA Technology.

**BT602 Advanced Cell Biology (80 Hours):** Cell, Chromosome and Plasma Membrane Structures and Behaviors. Mechanics of Cell Division. Sites of Macromolecular Synthesis and Processing. Transport Across Cell Membranes. Cell Dynamics. Organelle Biogenesis. Cell Specialization. Cell-to-cell Signaling. Hormones and Receptors. Signal Transduction Pathways. Second Messenger Molecules. Cell Adhesion. Extracellular Matrix. Cell Cycle. Programmed Cell Death. Methylation of DNA and Modification of Chromatic Structure. Abnormalities in Signal Transduction Pathways to Oncogenesis and Other Disease States.

**BT603 Biochemistry (80 Hours):** Structure and Function of Biomolecules. Purification and Characterization of Biomolecules. Separation Methods. Metabolic Pathways. Enzymes. Enzyme Mechanism of Action. Enzyme Kinetics and Thermodynamics.

**BT604 Introduction to Bioinformatics (60 Hours):** Introduction. Text-based and Functional Databases. Sequence Databases. Structure Databases. Genomics Databases. Transcriptomics. Proteomics Databases. Biological Data Integration. Literature Analysis. Text analysis. Information Retrieval. Information Extraction. Applications. Sequence and Structure Analysis. Phylogeny. Biomolecule Structure Prediction Methods.

**BT605 Biostatistics (60 Hours):** The Role of Statistics in Biology and Computational Biology. Random Sampling and Data Description. Point Estimation of Parameters. Statistical Intervals. Single Sample. Tests of Hypotheses. Statistical Inference. Simple Linear Regression and Correlation. Multiple Linear Regressions. Design and Analysis of Single-Factor Experiments: Analysis of Variance. Design of Experiments. Nonparametric Statistics. Multivariate analysis. Bayesian networks. Neural networks. Classification and Clustering.

### Advanced Courses:

**BT701 Genomics and Proteomics (60 Hours):** Genomics. Genome Diversity. Genome Sequencing. Genotyping. Transcriptomics. Microarray Technology, Pharmacogenetics. Comparative Genomics. Proteomics. 2D Electrophoresis. Mass Spectrometry. Bioinformatics in Proteomics. Metabolomics. Platform Technologies in Metabolomics. Regulatory and Standardization Issues. Experimental design and data analysis.

**BT702 Immunology and Vaccines (60 Hours):** Cellular Immunology. Antigen and Antibody Structure and Function. Effector Mechanisms, Complement. Major Histocompatibility Complexes. B- and T-cell Receptors. Antibody Formation and Immunity. Cytotoxic Responses and Regulation of the Immune Response. Applied Aspects of Immunology. Immunoassays. Antibody Engineering. Vaccines.

**BT703 Synthetic and Systems Biology (70 Hours):** Synthetic Biology. Device Fabrication Characterization. System Design and Synthesis. Enabling Infrastructure. Applications. Systems Biology. Logical Dynamics of Gene Expression. Information Processing in Biological Networks. Cellular Decision Making. Molecular Oscillations. Spatial and Temporal Organization in Cells. Modularity and Robustness in Cellular Networks.

**BT704 Recombinant Protein Production (70 Hours):** Overview Expression Hosts. Expression Elements. Protein Folding and Stability. Protein Expression Strategies. Protein Antigenicity. Microbial Bioreactors. Cell Culture Production Systems. Production in Transgenic Animals. Downstream Processing. Protein

Purification. Protein Quality Control. Biologicals. Regulations and Quality Demands.

**BT705 Nanobiotechnology (70 Hours):** Unique Functional Properties of Natural and Synthetic Biomolecular-sized (Nanometer-scale) Constructs. Quantum Dots. Carbon Nanotubes. Nanostructured Surfaces. Liposomes. Artificial Membranes. Molecular Machines for Biotechnology and Medicine. Research, Development, and Applications of Nanotechnology to Medical Diagnostics. Imaging. Therapeutics (Including Drug Delivery and Anticancer Treatments). Cell Biology. Single-cell Analysis. Nanofluidics. Bioassays. Biosensors. Bio-inspired Engineering.

**BT706 Industry Perspective Seminar (50 Hours):** In the initial part of this module, industry experts will be invited to deliver talks on the state-of-the-art technologies and happening in the industry to enable students to know the industry requirements. In the later part, the students have to present seminars on the latest topics in their domain.

**Project:**

**BT801 Project (400 Hours):** Students can take up an industry-sponsored project or in-house project as one of the requirements of this program. For industry-sponsored projects, the Career Management Cell facilitates interaction between students and the industry. The students can also take-up the in-house projects under the guidance of the faculty and/or industry experts in their area of expertise. Students are encouraged to work on projects that will enhance their understanding in certain technology domains in real-life scenario. The project report has to be submitted to the Institute in the prescribed format, and which will be examined by experts nominated by the Institute. The project is the culmination of the student's learning in the Institute and is expected to be of high standards as demanded by the industry from time to time.

Program Structure			
Level	Subject Code	Subject Name	Hours
Basic	CS001	Life Skills Development - I	20
	CS002	Life Skills Development - II	20
	CS003	Life Skills Development - III	20
Core	BT601	Molecular Biology	80
	BT602	Advanced Cell Biology	80
	BT603	Biochemistry	80
	BT604	Introduction to Bioinformatics	60
	BT605	Biostatistics	60
Advanced	BT701	Genomics and Proteomics	60
	BT702	Immunology and Vaccines	60
	BT703	Synthetic and Systems Biology	70
	BT704	Recombinant Protein Production	70
	BT705	Nanobiotechnology	70
	BT706	Industry Perspective Seminar	50
Project	BT801	Project	400
	<b>Total Hours: 1200</b>		