



# **North South University**

**Department of Biochemistry & Microbiology**

**Curriculum**

**for**

**MS in Biotechnology (36 credits)**

Master of Science in Biotechnology (MS BBT)  
Department of Biology and Chemistry  
School of Health & Life Sciences  
North South University  
Bashundhara, Dhaka 1229

**Foundation Courses (12 credits)**

<b>Course Code</b>	<b>Title</b>	<b>Credits</b>
BBT 601	Biochemistry	3
BBT 608	Advanced Biochemistry & Molecular Biology	3
BBT 615	Molecular Cell Biology	3
BBT 622	Microbial Biotechnology	3
<b>Total</b>		<b>12</b>

**Core Courses (18 credits)**

<b>Course Code</b>	<b>Title</b>	<b>Credits</b>
BBT 630	Immuno Biotechnology	3
BBT 638	Molecular Virology	3
BBT 645	Plant Biotechnology	3
BBT 652	Industrial Biotechnology	3
BBT 671	Bioinformatics	3
BBT 685	Biostatistics	3
<b>Total</b>		<b>18</b>

**Elective Courses (6 credits)-Take any 2 course; Thesis can be substituted with 2 courses**

<b>Course Code</b>	<b>Title</b>	<b>Credits</b>
BBT 659	Genes & Disease	3
BBT 695	Pharmaceutical Biotechnology	3
BBT 741	Introduction to cGMP Compliance	3
BBT 751	QA/QC for the Pharmaceutical & Biotechnology Industries	3
BBT 780	Biotechnology Entrepreneurship	3
BBT 701	Thesis	6
<b>Total</b>		<b>6</b>

## Course Description

### Foundation Courses (12 credits)

- BBT601**      **Biochemistry:** This course explores the roles of essential biological molecules including proteins, lipids, and carbohydrates, with an introduction to nucleic acids. Students examine the structure of proteins, their function, the methodologies for the purification and characterization of proteins, and the alteration of protein function through protein engineering. Enzymes and their kinetics and mechanisms are covered in detail. This course provides the linkage between the inanimate world of chemistry and the living world of biology. 3 CREDITS
- BBT608**      **Advanced Biochemistry & Molecular Biology:** This course focuses on intermediary metabolism and the role carbohydrates and lipids play in cell function. In addition, students examine nucleic acid structure and function and investigate the tools used in recombinant DNA technology. Specific topics include glycolysis, Krebs's cycle, oxidative phosphorylation; and DNA replication, transcription, translation, gene regulation, targeted expression of desired genes in plants and animals and post-transcriptional gene silencing like RNA interference (RNAi). 3 CREDITS
- BBT615**      **Molecular Cell Biology:** Course will introduce to the experimental techniques used in cell biology to study cell growth, manipulation, and evaluation. Students who successfully complete this course will be able to: i) Synthesize the complex processes of signal transduction pathways into a big picture. ii) Analyze mechanisms involved in regulation of the eukaryotic cell cycle. iii) Summarize the chemical components of cells and compare biosynthetic pathways. iv) Explain how proteins and lipids are transported into organelles, membranes and to the extracellular surface. Analyze and critique original research articles. Present scientific knowledge in professional setting. 3 CREDITS
- BBT622**      **Microbial Biotechnology:** This course provides current information on the applications of microbiology and its links with biotechnology. The syllabus will cover the following topics: i) Microbial Biotechnology: Sewage and wastewater treatment; Microbial transformations of xenobiotic compounds; Detection methods for pathogens; Biological control; Microorganisms and food production Microbial killing: pasteurisation, disinfection and preservatives; Algal biotechnology. ii) Bacterial genetics: Organization of the bacterial chromosome, prokaryotic DNA replication; Prokaryotic transcription and translation and regulation of gene expression and Extrachromosomal elements. iii) Industrial microbial fermentations: Isolation of microorganisms; Strain improvement; Fermentable substrates; Inoculum production; Outline of an industrial fermentation. Fermentation of engineered microorganisms, and Antibiotic production. 3 CREDITS

### Core Courses (18 credits)

- BBT630** **Immuno Biotechnology:** This course covers molecular and cellular immunology, including 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. Students are also introduced to the applied aspects of immunology, which include immunoassay design, various formats and detection methods, and flow cytometry. Special topics include immunomodulation, immunosuppression, immunotherapy, autoimmunity, and vaccination. 3 CREDITS
- BBT638** **Molecular Virology:** This course is designed to give an extensive knowledge of modern virology and fundamentals of molecular virology. The course include: Introduction to virology, Classification of viruses; Structure of virus particles; Virus growth in cell; The process of infection; Virus interaction with whole organism; Mechanism of Viral latency; transmission of viruses; the evolution of viruses; Genetic analysis of viruses. Genome Replication Strategies of DNA viruses; Genome Replication and RNA production by RNA viruses. An overview of Human viral diseases; HIV and AIDS; Carcinogenesis and tumor viruses; Polyomaviruses, adenoviruses, Retroviruses and human cancer, Vaccines and antiviral. Horizons in human virology; Technical advances; Recombinant Viruses as gene therapy vectors. Some methods for studying animal viruses. Emerging Virus infections; Influenza virus; SARS; Dengue virus, Virology and Society: For Good and ill. 3 CREDITS
- BBT645** **Plant Biotechnology:** In this course, students are introduced to the application of recombinant DNA technology to agriculture. Methods for the introduction of foreign DNA into plant and animal cells and generation of stably transformed plants and animals. Examples of the use of transgenic plants and animals in biotechnology, which can provide protection against insects, diseases, and tolerance to specific herbicides. Recombinant growth hormones for leaner meat, greater milk yield, better feed utilization, how transgenic plants and animals can serve as bioreactors for the production of medicinal or protein pharmaceuticals, methods of introducing foreign genes to plants, inducible control of gene expression, and use of different/suitable promoters for tissue specific expression. Because recombinant agricultural products are released into the environment or consumed as foods, The course will also cover the ethical point of GM agriculture along with biosafety issues. 3 CREDITS
- BBT652** **Industrial Biotechnology:** The course primarily associates with the commercial exploitation of microorganisms, and involves processes and products that are of major economic, environmental and social importance throughout the world. This course will provide an overview of industrial microbiology/biotechnology as an applied biological science. At the end of this course, students will appreciate the breadth of industrial biotechnology, and be able to discuss broadly the use of fermentation technology in these areas. They should be able to discuss how different types of industry may obtain, handle, and maintain microorganisms. Fermenters will be considered as a major part of this subject. Students will be able to utilize the basic principles behind the operation of batch and continuous fermenters; discuss the differences between industrial processes that are purely chemical processes and those that are microbiological, and discuss the different uses of batch and continuous fermentation for different industrial purposes.

They will be aware of the different methods of genetic improvement that have been used to modify microorganisms for different fermentations. They will learn examples of the modification of chemical compounds in microbial processes. 3 CREDITS

**BBT671**      **Bioinformatics:** Retrieval and analysis of electronic information are essential in today's research environment. This course explores the theory and practice of biological database searching and analysis. In particular, students are introduced to integrated systems where a variety of data sources are connected through worldwide web access. Information retrieval as well as interpretation is discussed and many practical examples in a computer laboratory setting enable students to improve their data mining skills. Methods included in the course are searching the biomedical literature, sequence homology searching and multiple alignments, protein sequence motif analysis, and several genome analytical methods. Classes are held in a computer laboratory. Acquaintance with computers is required. 3 CREDITS

**BBT685**      **Biostatistics:** This course introduces statistical concepts and analytical methods as applied to data encountered in biotechnology and biomedical sciences. It emphasizes the basic concepts of experimental design, quantitative analysis of data, and statistical inferences. Topics include probability theory and distributions; population parameters and their sample estimates; descriptive statistics for central tendency and dispersion; hypothesis testing and confidence intervals for means, variances, and proportions; the chi-square statistic; categorical data analysis; linear correlation and regression model; analysis of variance; and nonparametric methods. The course provides students a foundation to evaluate information critically to support research objectives and product claims and a better understanding of statistical design of experimental trials for biological products/devices. *The program also acquaints students with SPSS or "R" or STATA program.* 3 CREDITS

**Elective Courses (6 credits)-Take any 2 course; Thesis can be substituted with 2 courses**

**BBT659**      **Genes and Disease:** Because of recent advances, powerful diagnostic tests now detect genetic diseases, and there is promise of gene replacement therapy. In this course students cover general genetic principles, DNA tools for genetic analysis, cytogenetics, gene mapping, the molecular basis of genetic diseases, animal models, immunogenetics, genetics of development, genetics of cancer, and treatment of genetic diseases. Molecular methods of analysis are emphasized. 3 CREDITS

**BBT695**      **Pharmaceutical Biotechnology:** This course deals with the facts and figures about the Biopharmaceuticals, and discussions of how biotechnology is applied in human and animal health care, and in industrial and environmental processes. Pharmaceutical Microbiology course consists of Ten topics: (1) Pharmaceuticals, Biologics and Biopharmaceuticals; (2) Antimicrobial Compounds; (3) Recombinant and Synthetic Vaccines; (4) Enzyme Therapeutics; (5) Recombinant Pharmaceuticals; (6) Monoclonal Antibodies and Recombinant Antibodies; and (7) Nucleic Acids as Therapeutic Agents.. 3 CREDITS

- BBT741**      **Introduction to cGMP Compliance:** This course will introduce students to the cGMP model for quality systems. Compliance to current Good Manufacturing Practices is required in the production of biotechnology as well as drug products. After an introduction to the history of cGMP and the current regulations as they exist today, participants in this course will learn to develop quality systems that will ensure compliance. Topics will include cGMP history, to the applicable regulations, comparison of other Regulatory models, Quality Assurance/Quality Control, Document Management and Systems Implementation. 3 CREDITS
- BBT751**      **QA/QC for the Pharmaceutical and Biotechnology Industries:** There are many new quality initiatives for drugs, biotech products and medical devices that have been recently introduced. These include risk based, science based and systems based assessments. Students will be presented with a comprehensive overview of the current best practices in quality assurance and quality control. Students will also be exposed to the most recent theories and expectations from the Food and Drug Administration. 3 CREDITS
- BBT780**      **Biotechnology Entrepreneurship:** This course focuses on entrepreneurship and venture creation as key engines for wealth creation and successful business strategy in the modern, innovation- intensive, high-tech economy. The course deals with key issues such as: (1) assessing attractiveness of opportunities; (2) launching a new venture; (3) nurturing, growing and entrepreneurial venture; (4) obtaining the necessary financial, human and technology resources; (5) managing the transition from a small entrepreneurial firm to a large, sustainable, professionally managed but still entrepreneurial corporation; and (6) being an entrepreneur and promoting entrepreneurship in a large corporation. 3 CREDITS
- BBT701**      **Thesis:** Students in the biotechnology program have the opportunity to enrol in an independent research course. This elective course is an option after a student has completed at least eight graduate-level courses and has compiled a strong academic record. Prior to proposing a project, interested students must have identified a research topic and a mentor who is familiar with their prospective inquiry and who is willing to provide guidance and oversee the project. The research project must be independent of current work related responsibilities as determined by the project mentor. The mentor may be a faculty member teaching in the biotechnology program, a supervisor from the student's place of work, or any expert with appropriate credentials. Prerequisites: All foundation courses and four core courses. 6 CREDITS