

Department of Life Sciences

Bachelor of Science in Biochemistry and Biotechnology

An Overview

Biochemistry is the study of the molecular reactions of life, whereas Biotechnology focuses on the application of this knowledge. Biochemistry has taken the forefront in defining broadly based opportunities in Biotechnology applications that indicate the path for biologically based future of the twenty-first century. The two disciplines go hand in hand and nowadays there is little distinction between the two. The Bachelor of Science in Biochemistry and Biotechnology program at North South University (NSU) is a merger of the above two disciplines, first of its kind in Bangladesh. The program integrates the molecular life sciences from the most basic biology-chemistry interface to advanced molecular biology, molecular genetics, bioinformatics and genetic engineering. The program provides a 4-year academic program leading to the undergraduate B.S. Honors degree in Biochemistry and Biotechnology. Majors have the opportunity through extensive coursework, laboratories, seminars and projects to develop the knowledge and skills necessary to enter the workforce or to go on with further graduate education leading to MS or Ph.D. degree in Biochemistry and Biotechnology or related subjects at home and abroad. Under the MOU signed between NSU and ICDDR,B, Department of Life Sciences in association with several world class laboratories of the world will cater to our practical and laboratory aides. During the first year, students will be studying general education courses (GED) with a total of 27 credits together with a 4-credit subject major course of Introductory Biochemistry and Biotechnology. Total credits for BS in Biochemistry & Biotechnology amounts to 127 credits.



Pro Vice Chancellor is addressing a seminar organized by the School of Life Sciences

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Career in Biochemistry/Biotechnology

The solutions to some of the most urgent problems in the present day world, such as those in food production, medicine and the environment and the clues to some of life's most fundamental questions depend on the application of biochemical knowledge. And the emerging biotechnology sector both nationally and regionally will increase the demand for persons with significant training in biochemistry, molecular biology, and genetics. The department of Biochemistry and Biotechnology provides a broad education to meet that challenge. It also provides practical experience and technical training in a rapidly expanding area where skills are in short supply. A degree in Biochemistry and Biotechnology provides students with the training they need to become part of the broad biotechnology and life sciences industries at home and abroad. They can also pursue a research career at the emerging National Institute of Biotechnology in Bangladesh or at Universities and Research Institutes of the advanced West.

Course Distribution
BS in Biochemistry & Biotechnology

Courses	Titles	Credits
1st Semester (9 credits)		
ENG102/ ENG103	Introduction to Composition/ Intermediate Composition	3
BBT101	Introductory Biochemistry & Biotechnology	3
MIC101	Basic Microbiology	3
2nd Semester (12 credits)		
BBT103	Communication & Computer Application	3
CHE101	General Chemistry	3
BBT116/MIC116	Math for Biologists	3
SOC101/PSY101	Sociology/ Psychology	3
3rd Semester (9 credits)		
BBT203	Biostatistics	3
BBT109	Laboratory I	3
BBT211/MIC 212	Physics for Biologists	3
4th Semester (9 credits)		
ENG105	Advanced Composition	3
BBT201	Biophysical Chemistry	3
BBT202	Bioorganic Chemistry I	3
5th Semester (12 credits)		
BBT204	Molecular Biology I	3
BBT205	Metabolism I	3
BBT206	Proteins and Enzymes	3
BBT209	Laboratory II	3
6th Semester (8 credits)		
BBT207	Human Physiology	3
BBT208	Nutrition	3
BBT210	Seminar	2
7th Semester (9 credits)		
BBT301	Bioorganic Chemistry II	3
BBT302	Metabolism II	3
BBT303	Immunology	3
8th Semester (12 credits)		
BBT304	Molecular Biology II	3
BBT305	Clinical Biochemistry	3
BBT307	Endocrinology	3
BBT310	Laboratory (III)	3
9th Semester (11 credits)		
BBT306	Molecular Genetics	3
BBT308	Plant Biochemistry	3
BBT206	Microbial Biotechnology	3
BBT311	Seminar	2
10th Semester (12 credits)		
BBT401	Cellular Biochemistry	3
BBT402	Chemistry of Natural Products	3
BBT403	Plant Biotechnology	3
BBT405	Bioinformatics	3

11th Semester (13 credits)

BBT404	Biochemical Immunology	3
BBT406	Human Nutrition	3
BBT408	Oncology and Virology	3
BBT450	Laboratory (IV)	4

12th Semester (11 credits)

BBT410	Neurochemistry	3
BBT412	Biochemistry of Drugs	3
BBT499	Project	3
BBT491	Seminar / Viva-Voce	2

Total Credits : 127**Syllabus**

Requirements for a FOUR YEAR Bachelor of Science degree in
Biochemistry and Biotechnology

Course structure

General Education Courses (GED) : 27 Credits

Subject Major : 100 Credits
Total : 127 Credits

Year-wise Course distribution**First Year**

GED : 27 Credits
Subject Major : 3 Credits
Total : 30 Credits

Second Year

Subject Major : 32 Credits

Third Year

Subject Major : 32 Credits

Fourth Year

Subject Major : 33 Credits

BS in Biochemistry**General Education Courses (GED) : 27 Credits**

Course No.	Course Name	Credits		Total Credits
		Theory	Lab	
*ENG102	Introduction to Composition	-	-	0
ENG103	Intermediate Composition	3	-	3
ENG105	Advanced Composition	3	-	3
BBT103	Communication & Computer Applications	3	-	3
SOC 101/ PSY101	Sociology/Psychology	3	-	3
MAT116	Calculus	3	-	3
CHE101	General Chemistry	3	-	3
BIO103	Biology I	3	-	3
MIC101	Basic Microbiology	3	-	3
PHY101	Physics	3	-	3
BBT116	Math for Biologists	3	-	3
BBT211/MIC 116	Physics for Biologists	3	-	3

Subject Major Courses

Course No.	Course Name	Theory	Lab	Total Credits
BBT101	Introductory Biochemistry & Biotechnology	3		3
BBT201	Biophysical Chemistry	3	-	3
BBT202	Bioorganic Chemistry I	3	-	3
BBT203	Biostatistics	3		3
BBT204	Molecular Biology I	3	-	3
BBT205	Metabolism I	3	-	3
BBT206	Proteins and Enzymes	3	-	3
BBT207	Human Physiology	3	-	3
BBT208	Nutrition	3	-	3
BBT209	Laboratory II	-	3	3
BBT210	Seminar	2	-	2
BBT301	Bioorganic Chemistry II	3	-	3
BBT302	Metabolism II	3	-	3
BBT303	Immunology	3	-	3
BBT304	Molecular Biology II	3	-	3
BBT305	Clinical Biochemistry	3	-	3
BBT306	Molecular Genetics	3	-	3
BBT307	Endocrinology	3	-	3
BBT308	Plant Biochemistry	3	-	3
BBT309	Microbial Biotechnology	3	-	3
BBT310	Laboratory III	-	3	3
BBT311	Seminar	2	-	2

* May be waived as per NSU admission policy

Course No.	Course Name	Theory	Lab	Total Credits
BBT401	Cellular Biochemistry	3	-	3
BBT402	Chemistry of Natural Products	3	-	3
BBT403	Plant Biotechnology	3	-	3
BBT404	Biochemical Immunology	3	-	3
BBT405	Bioinformatics	3	-	3
BBT406	Human Nutrition	3	-	3
BBT408	Oncology and Virology	3	-	3
BBT410	Neurochemistry	3	-	3
BBT412	Biochemistry of Drugs	3	-	3
BBT450	Laboratory	-	4	4
BBT499	Project	3	-	3
BBT491	Seminar / Viva-Voce	2	-	2

Total Credit for the program: 127 Credits

Bachelor of Science in Microbiology

An Overview

Microbiology is emerging as the key biological science. Microorganisms provide the models used in molecular biology for research. This research at the molecular level has provided, and continues to provide, the answers to numerous fundamental questions in genetics, metabolism and cell forms and functions. There is growing recognition of the potential of microorganisms in many applied areas. The ability of microorganisms to decompose materials such as herbicides, pesticides, and oils in oil spills; the potential of microorganisms as food supplements; the exploitation of microbial activity to produce energy such as methane gas for rural consumption; and the potential of new therapeutic substances produced by microorganisms - these and other uses of microorganisms are becoming increasingly attractive. Recombinant DNA technology, commonly referred to as genetic engineering, is one of the principal thrusts of the emerging high technologies in the biological sciences. Recombinant DNA technology makes it feasible to consider genetically manipulated microorganisms for commercial production of new and valuable products for a variety of purposes, e.g., medicinal, fuel, and food.

- ARC576 Building Automation and Hi-Tech Architecture:** Use of modern and contemporary materials and advanced systems in the building. Elevators, Escalators, CC TV, Fire fighting, Energy savings, Computerization, Water recycling, Rain water collection, Use of solar energy, green house etc. Glass, Steel, aluminium and other metals and factory products and building and finish materials. Construction systems and Equipment. 3 credits.
- ARC577 Building Systems Integration:** Advanced course on building design for greater performance, including the study of the anatomical and functional variations of building subsystems and their design implications, inter-system relationships and synergistic integration of building subsystems into the overall building; and the strategies for designing buildings of high functional performance and greater overall value. Advanced studies of environment and building systems, including development in building systems, urban systems, service systems, construction systems, materials and component systems, psychophysical considerations, systems analysis, and computer technology. Prerequisite: ARC263, 272. 3 credits.
- ARC578 Building Economics:** Study of factors affecting cost of building, the building market, construction cost, estimates and cost control, time value of money and building life-cycle cost, measuring the worth of investments, depreciation and tax consideration of cash-flows. Individual and team analysis of architectural development proposals addressing relevant economic topics and trends. Development, construction, finance, operation, and sale costs analyses. Potential and projected rate of return on investment over specific time periods. Economic and social forces impacting upon real-estate investment values. 3 credits.
- ARC579 Building Safety and Security:** Introduction to safety and security, difference between safety and security in buildings, implication on design, legislation and need for good safety and security in buildings, implication on design, legislation and need for good safety and security practices. Current practices with reference to safety from accidents, security in buildings, fire prevention and control, safety signs and symbols. 3 credits.
- ARC596 Advanced studies studio III- Thesis Research and development:** Background study for the design (ARC519). The conceptual and professional position of a defined and tested by identifying viable and significant projects with realistic problems within a given site, typically real ones. Documentation of the thesis project -a 2000-word report containing case studies, design concept and necessary technical information preliminary design proposal. Prerequisite: ARC510. 4.5 credits.
- ARC597 Methods of Inquiry on Architecture, City and Environment:** Introduction to methods and techniques of systematically generating behavioral and social information relevant to the programming, design, and evaluation of physical environments. Individual investigation of the work of particular architects, of specific buildings, and of the architecture of periods or regions, and aesthetic problems, comparative studies. Presentation in a seminar. 1.5 credits. Lecture/Field/Presentation
- ARC598 Seminar on Art, Architecture, Society and Culture:** Generation of social and cultural information that affect design and physical environments. Individual investigation/fieldwork on a selected topic falling broadly in the areas of art, architecture, society or culture. Seminar presentation. 1.5 credits. Field/Presentation.
- BBT101 Introductory Biochemistry and Biotechnology:** History, scopes and future of Biochemistry and Biotechnology. The students will learn the basic logics of living system. The role of biomolecules and their interrelationships will be discussed. Carbohydrates; Lipids, Amino Acids and Peptides, Proteins, Fibrous Proteins, Globular Proteins, Protein isolation, Purification and Characterization, Nucleic Acids. 3 credits.
- BBT103 Communications & Computer Applications:** Provides a general understanding of computer applications and functions of the components of a computer system. Topics include components of computer systems, concepts of software; introduction to operating systems; history of computer languages, programming fundamentals, basics such as constant, variables, data type, operators and expressions, pointer; concepts of database; internet technology and World Wide Web. This course undertaken in a lab setting also provides functional orientation to word processing, spreadsheet, presentation, and database and WebPages design. Students also learn some basic skills in searching and evaluating online resources. 3 credits.

BBT116/MIC116: Math for Biologists: Basic concept of functions-polynomial, exponential, logarithm and trigonometric functions, limits and continuity.

Differentiation: Rules and techniques of differentiation of various functions, Concavity and convexity of a curve, Points of inflexion, Asymptotes and curvature, Functions of two or more variables, Partial derivatives, Euler's theorem on homogeneous functions, Mixima and Minima of functions; Integration: Rules and techniques of Integration, Simple application of integral calculus-rectilinear motion, Average value, Area between two curves, Double and triple integrals, Volume of a solid body; Vector Analysis: Vectors and scalars, Algebra of vectors, Vector differentiation and vector integration, Gradient, divergence and curl, Cartesian, Spherical, Polar and Cylindrical coordinate systems, Green's theorem, Divergence theorem and Stokes theorem; Differential Equations: Introduction to differential equation, firstorder differential equation, application of first order differential equation. 3 credits.

BBT201 Biophysical Chemistry: Thermodynamics ? First law; Second law; Thermochemistry; Chemical equilibrium; Chemical Kinetics; Spectrophotometer; Acids and Bases; Properties of Liquids. 3 credits.

BBT202 Bioorganic Chemistry I: This course gives the in-depth knowledge on chemical bonding and introduces stereochemistry and stereoisomerism. Students will learn the occurrence, structure, nomenclature, synthesis, physical and chemical properties of organic compounds including alkyl halides, alkenes and alkynes, alcohols, ether, epoxides, diols, dienes, aldehydes and ketones, carboxylic acids and their derivatives, nitro compounds and amines, phenols etc. relevant to living systems. 3 credits.

BBT203 Introduction to Bio-statistics: Statistics and its application. Variables and Attributes. Classification and tabulation of data. Populations and samples. Frequency distributions. Graphical presentation of data. Describing and summarizing data: statistical averages, measures of dispersion and shape characteristics. Linear regression and correlation. Basic probability: random experiments, events, definitions of probability, permutation and combinations, probability rules, random variables and expectations, binomial and normal distributions. Study design, population with particular reffence of life science. Estimation of parameter, sampling. Hypothesis, test of hypothesis, z-test, t-test, 2-test, F-test. Analysis of variance. Regression and coefficient, simple and multiple regression analysis. Interpretation of coefficient, application in life science data. 3 credits.

BBT204 Molecular Biology I: This course is designed as an undergraduate level introduction to the subject of molecular biology. An overview of - Life: Concept, identifying characters, organization, metabolism, homeostasis, adaptation, reproduction, ageing and death; Cell : Molecules to cells, cell components and their function, isolation of sub- cellular organelles, prokaryotes and eukaryotes, eukaryotic cell types, cell division - mitosis and meiosis; Heredity : Mendel's laws of inheritance, gene concept, conceptual relationship between gene and chromosomes, and gene and enzymes; DNA as a genetic material; DNA structure; Chemistry of nucleic acids; Gene expression; Application of Molecular Biology will be presented. 3 credits.

BBT205 Metabolism I: This course is designed to teach Bioenergetics, key metabolic pathways, for example glycolysis and the citric acid cycle. Students will be expected to understand how metabolic pathways are controlled and regulated, how metabolic energy is being utilized. Catalytic mechanism of certain important reactions of metabolic pathways will also be discussed. 3 credits.

BBT206 Proteins and Enzymes: This course will focus primarily on protein structure and functions of catalytic proteins. Factors effecting enzyme-catalyzed reactions and mechanisms of catalysis will be taught. This course will give some appreciation of Brief history and classification of enzymes; Enzyme as biological catalysts; Factors affecting the rate of enzymatic reactions; Enzyme kinetics; Enzyme Inhibition; Factors affecting the efficiency of enzymes as catalysts; Specificity of enzymes; ES-complex assay; Enzyme regulation; Mechanism of enzyme action; Novel enzymes; how enzymes can take advantage of fundamental physical and chemical interactions to catalyze the specific organic reactions necessary to maintain the life in organisms. 3 credits.

- BBT207 Basic Immunology:** This course covers all major topics of basic immunology. Principles of innate and adaptive immune responses, histocompatibility, humoral immunity, cell-mediated immunity (CMI), CMI and host defense, cellular activation, inflammation, disorders of the immune systems etc will be discussed. The topic will provide the student with a thorough understanding of the fundamental principles of modern immunology, and make familiar with the most important immunochemical and cellular immunological techniques. 3 credits.
- BBT208 Endocrinology:** This course will illustrate the basic functioning of the human endocrine system. Emphasis will be placed both on the learning of general concepts and application of these concepts to specific endocrine systems. The course will cover the following:
- General concepts of endocrinology, Characteristics of the hormone system, Hormone action, Pituitary and hypothalamic hormones, Thyroid and parathyroid hormones, Hormones of the adrenal cortex, Hormones of the adrenal medulla, Hormones of the gonads, Hormones of the pancreas, Gastrointestinal hormones, Hormone assay techniques. 3 credits.
- BBT209 Laboratory:** This is a laboratory-based course to provide students with an experience and understanding of selected methods, techniques, and instrumentation used in different biochemical researches. Students will learn many of the basic tools used in biochemistry and biotechnology. Much of this course is a hands-on laboratory-based introduction to basic general techniques. Students will also learn how these techniques are used in many exciting fields of general research. 3 credits.
- BBT210 Seminar- Objectives and outcome:** To give students the confidence to make oral presentations before small and large audiences, To train students in basic skills in preparing and delivering audio visual presentations including audience interaction and effective use of visual aids. 2 credits.
- BBT211/MIC212 Physics for Biologists:** In this introductory physics course the basic principles of mechanics will be explained and their application will be demonstrated (description of motion, cause of motion, auxiliary quantities). The application of mathematical means to solve mechanics-related problems will be practiced (vectors, calculus). By the end of the course, the students would be able to describe a mechanical process with the proper technical terms used in physics, to identify the mechanics-related problem, given a description of a situation, to solve mechanics-related problems with the right mathematical means. Prerequisite: BBT116/MIC116. Mechanics and properties of matter: Dimensions and units, Force and motion, Newton's laws of motion, frictional force, motion in one and more than one dimensions, uniform circular motion; work, energy and power; linear momentum; angular momentum and torque, elasticity, surface tension, viscosity; Oscillation and waves: Simple harmonic motion, damped harmonic motion, different types of waves, standing waves, Doppler Effect; Electricity: Electric charge and Coulomb's law; electric dipole; electric field, Gauss's law, electric potential; capacitors, electric current and Ohm's law, circuits, Magnetism: Magnetic field, Biot-Savart law, Ampere's law, Faraday's law of electromagnetic induction, Maxwell's equation; Optics: Light as electromagnetic wave, reflection and refraction of light, total internal reflection; interference of light; diffraction of light; polarization of light; Atomic Physics: The Bohr atom model, Hydrogen atom, Electron energy level and spectra, Electromagnetic radiation, photoelectric effect, X-rays Compton effect; Nuclear Physics: Nucleons, nuclear size, nuclear properties, Binding energies, radio-activity, nuclear reactions; Applications of Physics in Biological sciences, problems. 3 credits.
- BBT301 Bioorganic Chemistry II:** This course is a continuation of Bioorganic Chemistry I. Structure, synthesis and function of macromolecules like proteins, carbohydrates and nucleic acids and their basic units will be discussed. Synthesis of some natural products will be introduced. 3 credits.
- BBT302 Metabolism II:** The course is centered on how humans store, deliver, and use the fuel required for energy transduction. Specific topics include the pathways by which nutrients are stored, accessed and oxidized to provide ATP; hormonal regulation of energy balance and substrate utilization. Membrane structure and role of specific proteins in metabolite transports across membranes are introduced. Metabolism of lipids, amino acids and nucleotides, metabolic disorders and associated diseases and metabolism of xenobiotics are covered. 3 credits.

- BBT303 Nutrition:** This course is an introduction to nutrition, including nutritive value of foods, factors influencing body food requirements, their importance in promoting health and preventing disease and the body processes and their relation to total nutrition. Also, to develop a basic understanding of the scientific principles regulating nutrients and their digestion, absorption, transport, metabolism, storage, and excretion. 3 credits.
- BBT304 Molecular Biology II:** After Molecular Biology I this course will provide an advanced treatment of nucleic acids in terms of their structure, chemical nature and biological functions. The flow of genetic information via replication, transcription, translation and protein biosynthesis in both prokaryotes and eukaryotes will be introduced. Post-transcriptional events; recombinant DNA; genetic diseases; concepts of gene knockouts will be covered. 3 credits.
- BBT305 Clinical Biochemistry:** This course will introduce diagnostic enzymology and the role of clinical biochemistry in evaluating diseases related to hepatic, renal, respiratory, and thyroid function and genetic disorder. An overview of the biochemistry of various diseases such as atherosclerosis, hepatitis, diabetes, rheumatoid arthritis, obesity, gout, malabsorption syndromes, acidosis and alkalosis will be given. 3 credits.
- BBT306 Molecular Genetics:** This course will cover modern concepts and techniques of molecular genetics including Host controlled restriction and modification, plasmid incompatibility; General nature of mutation; Recombination; Gene expression; cloning; genetic libraries; sequencing; site-directed mutagenesis; genome analysis; genetic maps and markers; genetics of model systems including mouse, Arabidopsis, Drosophila, and C. elegans. Concept of epigenetics will be discussed. 3 credits.
- BBT307 Human Physiology:** This course is designed to facilitate a basic understanding of the normal functions of the human body; to be able to link between normal body function and structures; and to be able to integrate the clinical situations with the underlying physiological principles and concepts. 3 credits.
- BBT308 Plant Biochemistry:** The course will consider the structure and function of plant cell organelles. Included are discussions on photosynthesis, nitrogen fixation, role of plant hormones. The synthesis of alkaloids and general secondary compound biosynthesis will be discussed. Plant transformation techniques and examples of model transformation system will be introduced. 3 credits.
- BBT309 Microbial Biotechnology:** This course is designed to introduce students to areas and concepts involved in Microbial Biotechnology. They will learn various aspects of fermentation technology, immobilized biocatalyst, bioremediation, animal cell culture, food technology, and microbial antibiotic production. 3 credits.
- BBT310 Laboratory:** Students will participate in practical experiments of general Biochemistry and Biotechnology. These includes isolation/separation and assay of biomolecules, enzyme kinetics, protein estimation, separation and estimation of fatty acids/lipids, hormonal effects on biomolecules, isolation of plasmid DNA from E. coli, transformation of E. coli with plasmid DNA, isolation and assay of bacteriophage lambda, and amplification of DNA by polymerase chain reaction (PCR). In addition every student will be assigned a separate research project and will be asked to use library, INTERNET etc. to find information and submit a short report on the project. Assignment: Out of 200 marks of this course, 20 marks are allotted for an assignment. Every student will be assigned a separate project and will be asked to use library, INTERNET etc. to find information and submit a short report on the project. 3 credits.
- BBT311 Seminar:** The objective of this course is: To give students the confidence to make oral presentations before small and large audiences; and To train students in basic skills in preparing and delivering audio visual presentations including audience interaction and effective use of visual aids. The course will be evaluated by the faculty. 2 credits.
- BBT401 Cellular Biochemistry:** This course covers in-depth study of cell structures and functions. Cell organelles, cell membranes, transport, cell movements, cell-cell interactions, cell signaling, germ cells and fertilization, cellular mechanisms of development, differentiated cells and the maintenance of tissues are introduced. Cell cycle and clinical and molecular nature of cancer are also discussed. 3 credits.

- BBT402 Chemistry of Natural Products:** This course introduces techniques involved in mass production via cell and tissue culture of useful secondary metabolites like alkaloids and steroids. Students will learn the IR, UV, NMR and Mass spectroscopic techniques for structure determination of natural products. 3 credits.
- BBT403 Plant Biotechnology:** This course introduces various techniques that are currently being used in the rapidly expanding plant biotechnology industries. Students are expected to learn the theoretical and practical aspect of plantlet regeneration through tissue culture, development of genetically engineered plants for insect, virus, herbicide, and pesticide resistance, stress tolerance. Use of molecular markers for rapid and reliable screening of crop plants, antisense RNA technology, development of male sterile plants and hybrid seeds, production of synthetic seeds are included. 3 credits.
- BBT404 Biochemical Immunology:** This course deals with the biological and biochemical aspects of immunology, where the emphasis is on the molecular events involved in the development of an immune response. The course will provide to the student an up-to-date, detailed, and comprehensive overview of the molecular and cellular elements of the immune response. Focuses are on effector mechanisms of the immune response, and on the role of the immune system in health and disease. 3 credits.
- BBT405 Bioinformatics:** Bioinformatics and the Internet, Overview of Molecular Biology and Biological Chemistry, The Genetic Material, Gene Structure and Information Content, Protein Structure and Function, Bioinformatics tools, the NCBI Data Model, The GenBank sequence database, DNA sequencing, Editing DNA sequences, Submitting DNA sequences to the Database, Sequence Retrieval from Biological Databases (NCBI, EMBL, ExPasy), Sequence similarity searches (BLAST, FASTA, EMBL databases), Sequence Alignment (CLUSTAL X, Genedoc, Bioedit), Phylogenetic Analysis. 3 credits.
- BBT406 Human Nutrition:** This course is designed to understand the principles of nutrition and biological, chemical, and physiological basis of nutrients; Components of an adequate diet; Role of carbohydrates, proteins, fats and oils in human nutrition; Vitamins; Mineral and Trace elements; Energy metabolism; Protein energy malnutrition; Balanced diet; Identification of diseases associated with nutrient deficiency, healthy, balanced and appropriate dietary plans for specific conditions and dispensing correct nutrition information in health care settings will be covered. 3 credits.
- BBT408 Oncology and Virology:** This course is divided into two sections. The oncology section gives the epidemiology, molecular biology, Metastasis: Pathways and mechanism; and Carcinogenic agents and their cellular interactions and immunology of cancer. Types of cancers, their advanced diagnosis and treatments are covered. The virology section introduces an overview of virology that includes the nomenclature and taxonomy, structure and propagation, effect of animal viruses on host cell, pathogenesis, prevention and control of viral infection. 3 credits.
- BBT410 Neurochemistry:** Neurochemistry is an integrated, multi-disciplinary functional neuroscience course, emphasizing the Structure and function of brain and structural, biochemical and molecular mechanisms of the nervous system in relationship to neurological dysfunction and neurodegeneration. Aspects of malnutrition and brain development, and associated diseases are emphasized. 3 credits.
- BBT412 Biochemistry of Drugs:** This course is designed to give a detailed knowledge on prescription and nonprescription drugs which include broad classification and features of drugs with specific examples. Pharmacokinetics, molecular mechanism of drug action, drug design, drug targeting and pharmacogenomics are included. 3 credits.
- BBT450 Laboratory (Lab Work):** In this practical laboratory course students will learn various techniques, methods, assays, and protocols related to metabolism, environment and molecular biology, pharmaceuticals, and cellular and clinical immunology. 4 credits.
- BBT490 Project:** Every student will be required to participate in a project related to Biochemistry and Biotechnology under the supervision of an advisor, approved by the chairman. 6 credits.

- BBT491 Seminar:** Objective: Each student will present a seminar before an audience on designated project. This is designed to: train students to plan and execute a research project, give students the confidence to make oral presentations before an audiences, train students in basic skills in preparing and delivering audio visual presentations including audience interaction and effective use of visual aids. 2 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 and 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). Prerequisite: BBT601 Biochemistry. 3 credits.
- BBT615 Advanced Cell Biology I:** This course covers cell organization and subcellular structure. Students examine the evolution of the 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, and cell specialization. Students also are introduced to the experimental techniques used in cell biology to study cell growth, manipulation, and evaluation. Prerequisite: BBT601 Biochemistry. 3 credits.
- BBT622 Microbiology:** This course is an overview of microorganisms important in clinical diseases and biotechnology. Students are introduced to the general concepts concerning the morphology, genetics, and reproduction of these microbial agents. Lectures focus on individual organisms with emphasis on infectious diseases, biotechnology applications, molecular and biochemical characteristics, and molecular and serological identification methods. Students will also discuss the impact biotechnology, and particularly genomics, will have on the development of antibiotics and vaccines as treatment and preventative measures. 3 credits.
- BBT630 Principles of Immunology:** 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. Prerequisites: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology; BBT615 Cell Biology I. 3 credits.
- BBT638 Virology:** This course covers the advanced study of viruses with regard to the basic, biochemical, molecular, epidemiological, clinical, and biotechnological aspects of animal viruses primarily and bacteriophage, plant viruses, viroids, prions, and unconventional agents secondarily. Specific areas of virology, including viral structure and assembly, viral replication, viral recombination and evolution, virus-host interactions, viral transformation, gene therapy, antiviral drugs, and vaccines, are presented. The major animal virus families are discussed individually with respect to classification, genomic structure, virion structure, virus cycle, pathogenesis, clinical features, epidemiology, immunity, and control. The viral vectors and their applications in biotechnology are discussed. Prerequisite: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology.
- BBT645 Plant Biotechnology:** In this course, students are introduced to the application of recombinant DNA technology to agriculture. Studied are methods for the introduction of foreign DNA into plant and animal cells and generation of stably transformed plants and animals. Students consider specific

examples of the use of transgenic plants and animals in biotechnology, which can provide protection against insects, diseases, and tolerance to specific herbicides. They also investigate how recombinant growth hormones can result in leaner meat, greater milk yield, better feed utilization, how transgenic plants and animals can serve as bioreactors for the production of medicinals 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, students also need to become familiar with environmental safety issues. Prerequisites: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology; BBT615 Advanced Cell Biology I. 3 credits.

- BBT652 Industrial Microbiology:** This course covers the principles of various processes associated with the production and recovery of different bioproducts derived from prokaryotes and eukaryotes. Topics include the classification of microorganisms, media development, instrumentation, fermentation principles, mammalian and insect cell propagation, product recovery, protein purification, and the principles of current good manufacturing practices (cGMP). Emphasis is on large-scale production methods and production of recombinant proteins for diagnostic and clinical applications. Prerequisites: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology; BBT615 Advanced Cell Biology I. 3 credits.
- 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. Prerequisites: All four-core courses. 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 are 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 alignment, protein sequence motif analysis, and several genome analytical methods. Classes are held in a computer laboratory. Acquaintance with computers is required. Prerequisites: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology. 3 credits.
- BBT678 Practical Computer Concepts for Bio-informatics:** This course introduces students with a background in the life sciences to the basic computing concepts of the UNIX operating system, relational databases, structured programming, object-oriented programming, and the Internet. Included is an introduction to SQL and the Perl scripting language. The course emphasizes relevance to molecular biology and bio-informatics. It is intended for students with no computer programming background, but with a solid knowledge of molecular biology. Prerequisites: BBT601 Biochemistry. BBT608 Advanced Biochemistry and Molecular Biology. 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. Prerequisites: Basic mathematics (algebra); scientific calculator. 3 credits.

- BBT695 Pharmaceutical Biotechnology:** This course include - Pharmaceutical applications of recombinant technology, biophysical and biochemical analysis of recombinant proteins, production of biotech compounds, additional biotechnology related techniques, gene therapy vaccines, monoclonal antibody based pharmaceuticals, recombinant human deoxyribonuclease and dispensing of biotechnology products. 3 credits.
- BBT701 Research in Biotechnology (For thesis student):** Students in the biotechnology program have the opportunity to enroll 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 two core courses. 6 credits.
- BBT708 Economic Aspects of Biotechnology:** This course examines the economic, business, and financial forces that define and shape the biotechnology industry, with special focus on early stage and growing companies. A major focus is on decision making under uncertainty, which includes how to interpret and screen various input types in the decision process and how to balance the empirical and intuitive approaches to analyzing problems arising from the nature of the biotechnology business. The course will permit the student to prepare an analytic approach to complex problems, identify and assess risks and payoffs, evaluate risks and payoffs in monetary and non-monetary terms, develop a structure for strategy and tactics, and understand how and why people make the decisions they make. Topics include defining and distinguishing the biotechnology industry, competitive forces and impact on strategy, regulation of genetic products, planning under uncertainty, system thinking and system failure, the economic environment, estimating costs and benefits, strategic components, marketing and sales, research and development, and valuing a company. 3 credits.
- BBT713 Managing Biotechnology Professionals:** The roles of managers and leaders within biotechnology companies undergo constant change. Biotechnology managers must engage in new and innovative problem-solving strategies; lead a diverse and global workforce; develop partnerships with other businesses, customers, and competitors; manage horizontally and across teams; and utilize technology as a competitive advantage. The student is able to address current challenges in his/her own organization and learn methods of implementing change, such as negotiation techniques and motivation. The course includes in-depth discussions of leadership skills, communication, conflict resolution, and goal integration. Students research a biotechnology organization and analyze what is working and not working within the management systems and suggest alternatives. 3 credits.
- BBT721 Marketing Aspects of Biotechnology:** This course introduces students to the strategic and tactical approaches used in the marketing of biotechnological products and services. Students gain a thorough understanding of the research and planning necessary to develop a marketing plan, the relationship between the marketing and sales functions, the difference between marketing a scientific product and a scientific service, pricing strategies, distribution alternatives, communications, promotion, and the importance of perception. Knowledge of marketing terminology and techniques prove helpful to anyone in the industry. 3 credits.
- BBT731 Managerial Finance for Biotechnology:** This course integrates the tools of financial analysis with real-world problems in the technology industries. Topics include modeling, costs and benefits, and ratio and break-even analysis. Students will read, prepare, and analyze financial statements. The difference between management financial and tax financial statements will also be covered. 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.
- BBT760 Ethical, Legal, and Regulatory Aspects of the Biotechnology Enterprise:** This course provides an overview of the important ethical, legal, and regulatory issues that are critical to the biotechnology industry. The course is divided into the three sections of ethics, legal issues, and regulations, each section taught by a faculty member who specializes in the area. The three sections are organized to provide basic material in a way that allows for an appreciation of how each influences the others. The section on ethics introduces students to core ethical values that guide the practice of science in the biotechnology industry. The section on legal issues focuses on key legal concepts, such as protecting inventions and intellectual property, and licensing. The section on regulation addresses the range of regulatory oversight mechanisms with which the biotech industry must comply and strategies for doing so. 3 credits.
- BBT773 Biology of HIV and AIDS:** This course includes an overview of the biology and life cycle of the immunodeficiency virus, including the simian viruses (SIVs). Specific areas of HIV immunopathogenesis are emphasized, to include HIV diagnosis, HIV-induced immune dysfunction, and therapeutic breakthroughs in the treatment of HIV-1 disease. Students become familiarized with current methods in biotechnology that have advanced our understanding of the biology of retroviruses. Special topics include international genetic variation (subtypes and clades) HIV vaccine development and global economic impact. Prerequisites: BBT601 Biochemistry; BBT602 Advanced Biochemistry and Molecular Biology; BBT603 Advanced Cell Biology. 3 credits.
- BBT781 Protein Bioinformatics:** Because the gap between the number of protein sequences and the number of protein crystal structures continues to expand, protein structural predictions are increasingly more important. This course provides a working knowledge of various computer-based tools available for predicting the structure and function of proteins. Topics include protein database searching, protein physicochemical properties, secondary structure prediction, and statistical verification. Also covered are graphic visualization of the different types of three-dimensional folds and predicting 3-D structures by homology. Computer laboratories complement material presented in lectures. Prerequisites: BBT601 Biochemistry; BBT602 Advanced Biochemistry and Molecular Biology; BBT610 Bio-informatics. 3 credits.
- BBT785 Methods in Proteomics:** This course covers the analytical methods used to separate and characterize pharmaceutical compounds (predominantly proteins) derived through biotechnology. While emphasis is placed on the general principles and applicability of the methods, current protocols are discussed, and problem sets representing realistic developmental challenges are assigned. Topics include chromatography (HPLC, SEC, IEC), electrophoretic techniques (2-D gel electrophoresis), spectroscopic methods (UV/Vis, fluorescence, CD), analytical ultracentrifugation, microarrays, mass spectroscopy, amino acid analysis, sequencing, and methods to measure protein-protein interactions. Prerequisites: BBT601 Biochemistry; BBT608 Advanced Biochemistry and Molecular Biology. 3 credits.
- BBT791 Genomic Sequencing and Analysis:** The completion of the human genome sequence is just the latest achievement in genome sequencing. Armed with the complete genome sequence, scientists need to identify the genes encoded within, to assign functions to the genes, and to put these into functional and metabolic pathways. This course will provide an overview of the laboratory and computational techniques beginning with genome sequencing and annotation, extending to bioinformatics analysis and comparative genomics and including functional genomics. Prerequisites: BBT601 Biochemistry; BBT602 Advanced Biochemistry and Molecular Biology; BBT671 Bio-informatics. 3 credits.

- BEN205 Bengali language and Literature:** Styles of prose: Standard, Colloquial and Dialect. Review and practice of basic grammar and syntax and introduction to language skills. Development of integrated language skills with special focus on the mechanics of the language. Important aspects of grammar and vocabulary will be dealt with. This course will aim to show the trend of Bengali literature in the last 100 years by exposing the students to the popular work of major Bengali poets, short story writers, novelists and essayists. 3 credits.
- BIO103 Biology I:** The structure and function of living organisms in their natural environment. Exploring how plants and animals adapt and survive in their ambient environment. The basic unity of all living organisms in terms of cellular organization and the diversity that arises from this fundamental similarity. How animals adapt to their environment through their physiological and behavioral changes. 3 credits.
- BIO210 Introduction to Molecular Biology:** Description: The course focuses on the basic concepts in the molecular biology of the gene; cell structuring; the chemistry of Nucleic Acids, DNA, RNA; basic structure and function of proteins, three dimensional structure of DNA, replication, transcription, translation of the gene, characterization of gene products, control of gene expression and gene regulation, cloning of gene, practical applications. 3 credits. ✓
- BPS310 Strategic Planning and Control:** Analyzes the strategies and tactics used by firms in various competitive environments and provides operational experience to students who will be designing and evaluating strategies in emerging and mature industries. Focuses on the question of how firms can create and sustain a competitive advantage. It covers both formal planning and control systems and the informal processes that lead firms to change their strategic direction. Also explores new models and approaches to strategic planning and control including the "balanced score-card" methodology, the real options approach to evaluating alternatives; and biases affecting strategic decision-making at individual, group and organizational levels. Prerequisite: MGT210; FIN254. 3 credits.
- BPS320 Organizational Structure and Design:** Examines various techniques and theories of organizational structure and design. Topics include classical, neo-classical, contemporary and emerging design approaches; functional, divisional, geographical, hybrid, and matrix structures; hourglass, cluster, and network structures; problems and perspectives in designing organizations and developing organizational structures. Prerequisite: MGT210. 3 credits.
- BPS330 Organizational Development and Change:** Deals with the understanding of basic processes and systems of organizational development and provides an integrated and comprehensive view of the field of organizational development. Topics include organizational renewal and change, development process, intervention process, organizational culture, change in vision-- mission statement, consequent impact on organizational development (OD), and challenge and the future of organizational development. Prerequisite: MGT210. 3 credits.
- BPS410 Management of Technology and Innovation:** Deals with techniques of managing technological changes and innovations. Topics include technological environment, technological options, process of developing new products and ideas, innovation revolution, innovations and new ventures, strategies for creativity, technology and innovation risks, and American/Japanese approaches to managing the innovation process. Prerequisite: MGT210. 3 credits.
- BPS440 Creative Problem Solving:** Provides a logical framework for identifying, analyzing and resolving business problems that utilize the creative process. Focus will be on the use of divergent/convergent thinking techniques throughout all phases of problem analysis. Topics include improvisation in business decisions, creativity versus critical thinking, problem identification/definition, gathering/compiling information, and generating, evaluating and implementing ideas. Course is integrated using Sources and Uses of the Power Model and Improvisation techniques. Prerequisite: MGT210. 3 credits.
- BPS470 Supply Chain Management:** Introduce key concepts of supply chain management, best practices, innovative ideas, practical principles, and critical thinking of integrative demand and supply chain management. Prerequisite: MGT210. 3 credits.

techniques, knowledge representation and computer inference, machine learning, natural language understanding, computer vision, robotics, and societal impacts. Prerequisite: CSE225 and CSE232; or consent of instructor. 3 credits.

- CEG353 Electrical and Electronics Circuit Design Laboratory II:** Principles of instrumentation and data analysis and the development of methods of experimental analysis for testing theories and hypotheses. Prerequisite: CEG283. 2 credits.
- CEG363 Circuit Analysis:** Descriptions of signal wave forms, circuit differential equations and their solutions, convolution and impulse response, phasors and impedance, resonance, network topology, and formulation of loop, node and state equations. Prerequisite: CEG243 and MAT350. 3 credits.
- CEG373 Design and Analysis of Algorithms:** Advanced data structures, complexity analysis, sorting and searching, graph algorithms, arithmetic algorithms, geometric algorithms, string problems, parallel algorithms, NP-Completeness. Prerequisite: CEG373 and MAT361 or consent of instructor. 3 credits.
- CEG383 Linear Systems Analysis:** Methods of linear signal and system analyses, including Fourier transform, Laplace transform and state-space methods. Prerequisite: CEG363 and MAT350. 3 credits.
- CEG413 Digital Microprocessor Design Laboratory:** Design of digital systems with integrated circuits and MSI/LSI and microprocessor interfacing. Prerequisite: CSE331. 3 credits.
- CEG433 Computer Architecture:** Computer system analysis and design, performance and cost, instruction set architecture, processor implementation techniques, pipelining, vector processors, memory-hierarchy design, input/output. Prerequisite: CSE331. 3 credits.
- CEG482 Internet and Web Technology:** The course develops an in-depth knowledge of the concepts, principles and implementation techniques related to the Internet and web technology. Details about the Internet, Intranet, Extranet, and e-commerce will be covered. Topics include Web server management, threats, security of client and server, network security like firewall, SSL, etc., authentication and authorization, legislation, privacy and IP act, electronic payment, e-business, search engine, Internet protocols like TCP/IP, SGML, XML. Design and development of Web applications using Java Applets, ASP, Java Script, CGI and other Web tools is discussed. Prerequisite: CSE338. 3 credits.
- CEG497 Special Topics:** Variable Credits.
- CEG499 Laboratory - Special Project:** Variable credits.
- CHE101 General Chemistry:** For students having basic knowledge of Chemistry: Introduction to atomic structure, quantum mechanical atom, chemical bonding, valence shell electron pair repulsion theory for predicting molecular geometry. Their theory of chemical bond formation, Periodic table and period classification of elements with their properties, Transition elements and coordination chemistry, application of valence bond theory to coordination compounds, Chemistry of solids and crystals, States of matter, Different gas laws & kinetic theory of gases, stoichiometry, chemical equilibrium, environmental chemistry. Prerequisite: Chemistry in HSC. 3 credits.
- CSC273 Introduction to Theory of Computation:** Theorem proving, propositional logic, first order logic, finite automata, formal languages, Turing machines, uncomputability, computational complexity and NP completeness. Prerequisite: CSE173, CSE225. 3 credits.
- CSC281 Introduction to Digital Electronics:** Theory and operation of circuits used in digital computers including basic electrical circuit principles, diodes, bipolar and MOS transistors, digital logic circuits, memory circuits, and the fundamentals of analog circuits. Prerequisite: PHY108, CSE231. 3 credits.
- CSC311 Database Management Systems:** Examines the logical organization of databases: the entity-relationship model; the hierarchical, network, and relational data models and their languages. Functional dependencies and normal forms. Design, implementation, and optimization of query languages; security and integrity; concurrency control, and distributed database systems. Prerequisites: CSE225. 3 credits.

- EMB670 International Business:** This course aims at providing an understanding of international business from a global/multinational perspective. It focuses on the management challenges associated with developing strategies and managing the operations of companies whose business activities spread over more than one nation. The course analyzes the internationalization process in small, medium and large corporations, compares and contrasts different internationalization strategies, examines managing political risks and ethical issues in international business, and studies functional management of the transnational corporation, i.e. financial management, marketing management, human resource management, accounting and taxation issues. Prerequisite: EMB-502; 3 credits.
- EMB690 Strategic Management:** This is an integrative capstone course for MBA students. It is interdisciplinary in nature and covers all aspects of business management. The course has a global perspective and uses extensive case analysis to familiarize student with real life organizational issues. Prerequisite: All foundation and functional core courses; 3 credits.
- ENG102 Introduction to Composition:** Development of integrated language skills with special focus on the mechanics of the writing process. Study of grammar, with emphasis on sentence structures, paragraph writing with emphasis on concepts such as its topic sentence, controlling ideas, unity and coherence. 3 credits.
- ENG103 Intermediate Composition:** Emphasis on essay writing; thesis statement, introduction, conclusion, types of essays, narration, description, process analysis, contrast, comparison, cause and effect, editing and revision. Cross listed with ENG109. Prerequisite: ENG102. 3 credits.
- ENG105 Advanced Composition:** Continued work on analytic reading and on fluency and control of the writing process. Emphasis on sentence structure, organization, paragraphing, coherence and cohesion. Development of expressive, persuasive and referential writing with emphasis on planning, organization, cohesion and coherence. Participating in small group discussions and seminars. Employing appropriate mechanics of formal speech. Further practice in research techniques. Project work. Considered as GED requirement for students other than students of English. Prerequisite: ENG103/109. 3 credits.
- ENG109 Academic English 1:** The theory and practice of academic reading and writing, with an emphasis on expository writing, including narration, description, definition, process, cause and effect, comparison and contrast, classification and persuasion and informative forms of academic writing. Includes an emphasis on study skills. Prerequisite: ENG102. 3 credits.
- ENG110 Academic English II:** Further work in academic reading and writing. The focus of academic writing will be expository writing with an emphasis on argumentation, persuasion and research methodology. Writing proposals for various topics from areas of language and literature, different types of bibliography, primary and secondary sources, abstract writing, documenting sources following MLA style of documentation. The student is required to choose a topic approved by the instructor and write a research paper in about 5000 words. (S)He makes classroom presentation of research paper and defends queries. The research paper is an integral part of the course and without doing it the student cannot pass the course. Prerequisite: ENG103/ENG109. 3 credits.
- ENG112 Reading Skill and Vocabulary Building:** This course focuses on reading skills and lexis, and their interdependence. It makes an etymological approach to English vocabulary with a view to enriching the students' mental dictionary and thus aiding their receptive as well as productive skills in English. The course also puts emphasis on enhancing the pace of reading by using reading materials. 3 credits.
- ENG118 Introduction to Fiction:** This course investigates the uses and boundaries of fiction in novels and other narrative genres. Required reading list includes traditional and innovative as well as western and nonwestern texts. The course aims at raising questions about pleasures and meanings of texts in different cultures, times, and forms. 3 credits.
- ENG119 Introduction to Drama:** This course is an introduction to the literary genre collectively called drama or the play. The course approaches the genre as literature, but in order to understand this rich art form more fully, it studies and discusses a sampling of plays that exemplify different kinds of dramatic structure, including their literary, cultural, historical and social contexts. However, because

- MGT675 Total Quality Management (TQM):** Examines major issues of TQM, principles and theories. Evolution of TQM as a separate body of management theory is addressed. Topics include Deming's, Juran's and Crosby's TQM principles, leadership information and analysis, JIT, strategic quality planning, employee involvement and empowerment, human resources management in TQM, management of process quality, quality and operational results, customer focus and satisfaction, buyer-supplier-customer relationships in TQM, TQM models, quality performance management, study of ISO 9000 series and their applicability in Bangladesh. Prerequisite: BUS 520, MGT 604 for MBA students/ EMB520 and EMB601 for EMBA students. 3 credits.
- MGT680 Supply Chain Management:** Since its inception in the early 1990s, the field of supply chain management has become tremendously important to companies in an increasingly competitive global marketplace. This course focuses on the network of companies that work together to design, produce, deliver, and service products. Major topics include material, information, and capital flows, challenges to effective supply chain management, including variability, organizational silos, the Bullwhip Effect, and tradeoffs, product design and metrics for supply chain management; B2B integration, supply chain strategies, and impact of internet on supply chain management. Prerequisites: BUS 520 for MBA students/ EMB520 and EMB601 for EMBA students. 3 credits.
- MGT682/DEV582 Environmental Management:** This course presents the basic concepts and principles of environmental management, areas of global environmental concerns, strategies and tools for effective environmental management for managers of business and development organizations. Topics include: problems of development and production, the need for sustainable development, actions for environmental protection, environmental management tools - environmental assessment, economic assessment of environmental consequences, environmental impact statements, environmental audits, waste minimization programs, life cycle assessments and environmental design. The course will also discuss the process of environmental certification under ISO14001. Prerequisite: EMB520 and EMB601 for EMBA students. 3 credits.
- MGT690 Seminar on Advanced Management:** To be arranged and announced before the semester starts. Prerequisite: EMB520 and EMB601 for EMBA students. 3 credits.
- MIC101 Basic Microbiology:** The course deals with the basic knowledge of different groups of microorganisms and also a detailed study of morphology, nutrition, growth, cultivation and preservation of bacteria. Introduction to microbiology: Scope and evolution of microbiology. Protista. Prokaryotic and eukaryotic microorganisms. Different areas of microbiology. Microorganisms other than bacteria such as yeasts, molds, rickettsiae and viruses (brief study). 3 credits.
- MIC110 Introduction to Biochemistry:** The cell and its evolution from molecules to the first cell, from procaryotes to eucaryotes, structure and function of sub-cellular organelles, their isolation and identification. Biomolecules: Carbohydrates-structure and biological functions of carbohydrates. Polysaccharides. of biological interests. structure & their functions. Lipids. biological functions of different classes of lipids. Amino acids and peptides. Proteins. general introduction to proteins. Enzymes as biological catalysts, specificity, Enzyme kinetics, Enzyme inhibition. Nucleic Acids. DNA, RNA, introduction to structure of DNA, Double Helix, Central dogma of molecular biology. 3 credits.
- MIC201 Microbial Ecology:** Basic concept of Microbial ecology, Microbial communities and ecosystem, Brief introduction to microorganisms in natural habitat, Microorganisms in the atmosphere, hydrosphere ecology of fresh water, composition and activity of fresh water, role of microbes in the aquatic environment and lithosphere, Effect of abiotic factors on microorganisms, Adaptation and interaction of microorganisms in the extreme environment. 3 credits.
- MIC202 Basic Techniques in Microbiology:** Basic microbiology laboratory techniques, microscopes and microscopy, methods of cultivation of microorganisms, biochemical tests for identification of bacteria. Microscopy: Bright field, dark field, fluorescence, phase contrast, electron microscopy, principles and applications, or microscopic Heat sterilization. Sterilization by dry heat and moist heat, Bacteria: morphology, nutritional requirements, growth, preservation of pure cultures, Control of microbial growth. 3 credits.

distribution and access to goods and services. The main concern of this course is how the various aspects of globalization affect, and are affected by public policy and the capacity for governance at the international, national and local levels. The course contents are threefold: Overview and assess the analytic framework for mapping the development of globalization and its impact on democracy and sustainable development in such sectors as environment, education, health etc; highlights core concepts and its dynamics in relation to developing countries, and analyze how processes of globalization and international organizations affect public policy and governance. Elective, 3 credits.

PPG545 Public Sector Financial Management: The course attempts to analyze the financial management and the basics of financial and managerial control system geared to public sector management to address public policy and governance issues. The course analyzes the role and size of the public sector, the rationale for public sector interventions; public resource mobilization via taxation, external resource mobilization, national income and expenditure policy, public budgeting, assessment of government safety net program; and fiscal decentralization and intergovernmental fiscal relations. Elective, 3 credits.

PPG550 Fundamentals of Economics: The prime objective of the course is to introduce the students to the core concepts and theories and principles of economics. The students get the preliminary knowledge of the principles of economics to understand the public sector management and policy issues. Fundamental concepts of economics, Basic elements and applications of supply and demand; analysis of cost, market, and perfect competition; monopolistic competition, factor markets; overview of macro economics; consumption, savings, and investment; international trade and macro economy; money and banking; taxation and fiscal policy; and economic growth and policies. Elective, 3 credits.

PPG555 MPPG Thesis (Master Thesis): In writing the thesis, each candidate is required to pursue independent scientific work in close cooperation with an assigned supervisor. In the thesis, the candidate demonstrates his ability to comprehend a social issue relevant to his place of work or society and analyze the issue using research methods and theories learnt in the Program. The thesis is based on empirical data collected by the researcher and analyzed in accordance with research objectives and hypotheses. The MPPG Thesis highlights a topic / issue within public policy, governance, and organizational science. Probable topics may be education, health, governance, organizational/ administrative reforms, organizational learning, gender disparity, women empowerment, strategic and corporate management, leadership, poverty reduction programs, implementation of policies, and program evaluation, etc. The thesis or part of it is expected to be of publishable quality. Compulsory, 3 credits.

PPG560 Dissertation Seminar: The aim is to assist student in writing thesis. This is achieved through presentation of thesis chapters by students. Each student is required to present twice and be opponents to their fellow students' thesis chapters twice. The objective is to learn from each others' research work. This includes: a) Presenting thesis chapters, b) Commenting on peers' thesis chapters, c) Learning from each other's research work and improve the quality of thesis. Individual course/Research seminar. Compulsory, 3 credits.

PSY101 Introduction to Psychology: Study of human behavior with special reference to perception learning memory, thinking, emotional life, and individual differences in intelligence, aptitude, and personality. Includes of review of abnormal behaviors, their causes and possible solutions (therapy). Prerequisite: ENG102 recommended. 3 credits.

PSY105 Elements of Psychology: Description and explanation of psychological principles of everyday living, with emphasis on how behavior is motivated, how individual learn intelligent behavior, personality and application of psychology to various social issues. Lectures, discussions and five credits of participation a subject in psychological experiments. This course may be substituted for PSY100 when the latter is listed as a prerequisite or a recommended elective. 3 credits.

PSY201 Introduction to Social Psychology: Systematic study of social factors in individual and group behavior, attention to social perception, motivation and learning, attitudes, norms, and social influence processes, the development and dynamics of group and the effects of social cultural factors influencing efficiency. Prerequisite: PSY101. 3 credits.

- REL205 Introduction to World Religions:** This course looks at various definitions and methods of studying religion. Study of various religions including Islam, Christianity, Judaism, Hinduism, Jainism, Buddhism, Confucianism, Tao & Shinto. Discussion of comparative dogmas & doctrines; comparative eschatology and belief patterns, superstitions and taboo. There is also exposure to new movements in the world religions. 3 credits.
- SOC101 Introduction to Sociology:** Examination of how societies grow and change; reciprocal effects of economic, political, familial, and scientific institutions on each other and on individual life; changes and social conflict, problems of bureaucratic growth and planned and unplanned social change. 3 credits.
- SOC103 Introduction to Criminology:** The close relationship between crime, business and politics in politics in Bangladesh makes the study of criminology an interesting proposition. Introduction to Criminology is designed to provide students with a basic introduction (e.g. crime, deviance, delinquency, punishment, treatment, victimology, legal jurisprudence, legal defenses, restorative justice, etc.). A history of criminological thought and practice is presented with an emphasis on the continuities and discontinuities between early and modern day approaches in crime and criminal justice. Practical research skills are utilized by students through the construction, calculation and comparative assessment of nature of crimes and crime rates of Bangladesh. Practitioners in the areas of criminal justice, policing and victimology will address the students with practical knowledge of agency level functioning. 3 credits.
- SOC201 Contemporary Issues in Gender Relationship:** Historical background of the development of gender studies as a separate discipline; theoretical debates on gender role - socio-biological argument, materialist conception, private vs. public analysis, psychoanalytic perspective, environmental debate, ideological issues; concept of 'Gender' and 'Feminism'; gender methodology; Gender theory - integration vs. autonomy debate, politics of reproduction, ethno-methodological viewpoint; empirical issues- women and stratification, women and social mobility, women and development; women as vulnerable subject - control over women through institutions of marriage, education and religion; future of gender studies, problems and prospects of gender studies in Bangladesh. Prerequisite: ENG102. 3 credits.
- WES318 Gender Issues and Sustainable Development:** The direction and aim of development, gender relations, critical issues in rural and industrial development. There is a widespread perception that the development process is in a state of multiple crisis. While the notion of sustainable development is supposed to address adequately its environmental dimensions, there is still no agreed framework relating women to this new prospective. This course is an attempt to present and disentangle the various positions put forward by major actors and to clarify the political and theoretical issues that are at stake in the debates on women, environment and sustainable development. Topics include Conceptualizing development, Theoretical debates (WID, WAD AND GAD) Developmentalism: A discourse of power, Feminist Critiques of Science, the relationship between women and nature: debates within feminism (linkage: Women and Forestry, Women and water, Women and Agriculture, Women and Natural Disaster, Women and Environmental Education, Women and Environmental Preservation, Women and Marketing), Women, the Environment and Sustainable Development: Emergence of the theme and different views. Alternative Development, Environmental reforms and the debate of sustainable Development, Responses to the crisis from Deep Ecology, Social Ecology and Ecofeminism, Women targeted Environmental projects: Linkages, successes and failures. Case Studies Energy efficient appliances: solar/biogas projects, agro forestry, education etc. 3 credits.
- WMS201 Gender and Development:** The direction and aims of development; gender relations; critical issues in rural and industrial development as regards women's access to paid work; women's access to land, labor markets, income, credit and training; women's role in import substitution or export promotion strategies, implications for economic growth and social equality, employment generation and sexual division of labor; technological innovation and its impact on gender; economic crisis, structural adjustment policies and their implications for gender divisions in labor and well-being; gender policy relevant research needs, strategies, methods. Prerequisite: ENG102. 3 credits.