B.Eng. (Chemical and Biomolecular Engineering)
Course Description (AY2007/2008 intake)

BG1001 Engineering Physics (4 AU)
Electricity and magnetism. Geometrical and physical optics. Modern physics, covering photons, electrons and atoms, quantum mechanics and nuclear structure.

BG1002 Bioengineering Physics (4 AU)
Physical quantities and vectors. Motion of particles and rigid bodies. Work and energy. Elasticity. Fluids. Temperature, heat and ideal gases. Laws of thermodynamics.

BG1003 Chemistry for Engineers (4 AU) This course is an introduction to chemistry for students in bioengineering. Concepts of atoms, molecules and ions. Physical chemistry. Reaction kinetics. Chemical equilibrium. Ionic equilibrium. Electrochemistry. Inorganic Chemistry. Organic chemistry. Nomenclature and reactions. Polymers and polymerization.

BG1005 Materials Science (3 AU)
Bonding between atoms. Building blocks of materials. Crystal defects and diffusion. Structural properties of materials. Functional properties of materials. Phrases and microstructures. Applications to chemical engineering and bioengineering industries.

BG1006 Mathematics for Engineers A (3 AU)
First order differential equations. Second order differential equations. Sequences and series. Laplace transforms. Linear algebra. Matrix algebra. Partial differentiation.

BG1007 Mathematics for Engineers B (3 AU)
Engineering mathematics with emphasis on analytical methods: partial differentiation, multiple integrals, vector integral calculus. Fourier series, integrals and transforms. Partial differential equations.

BG1009 Anatomy & Physiology (4 AU)
Bones and Joints. Muscular System. Respiratory, Gastrointestinal, and Urinary System. Cardiovascular System. Basic Neuroanatomy. Structure of the Nervous System and Sensory Organs. Function of the Nervous System and Sensory Organs.

BG1031 Biomolecular Engineering I (4 AU)
Molecular basis of living systems. Biophysics of proteins. Principles of metabolic engineering. Cellular systems and dynamics. Genetics basis of cellular systems.

BG1701 Bioengineering Laboratory 1A (1 AU)
This laboratory course aims to provide practical demonstrations and applications to reinforce theories and concepts taught in first year of Bioengineering: Physics, Biomolecular Engineering I and Chemistry.

BG1702 Bioengineering Laboratory 1B (1 AU)
This laboratory course aims to provide practical demonstrations and applications to reinforce theories and concepts taught in first year of Bioengineering: Materials Science, Physics, Biomolecular Engineering I and Chemistry.

BG1008 Organic chemistry and Spectrophotometry (4 AU)
Introduction to organic chemistry. Stereochemistry. Alkyl halides and reactions. Alkenes, alkynes and their reactions. Alcohols and reactions. Spectroscopy: infrared, mass and nuclear magnetic resonance. Ethers, epoxides and sulfides. Conjugated systems and ultraviolet spectroscopy. benzene and aromaticity. Aromatic compounds and reactions. Ketones, aldehydes and carbonyl compounds. Amines and phenols. Spectroscopy: Structure determination.

BG2003 Fluids Systems (4 AU)
Macroscopic and microscopic fluid mechanics. Mass, energy, and momentum balances. Fluid friction in pipes. Flow in engineering equipment. Differential equations of fluid mechanics. Solution of viscous-flow problems. Laplace's equation for irrotational and porous medium flows. Boundary-layer and other nearly unidirectional flows. Turbulent flow. Bubble motion, two-phase flow, and fluidization. Non-Newtonian fluids.

BG2004 Electronics for Biomedical Engineers (4 AU)
Introduction to Electronics. Diodes. Bipolar Junction Transistors (BJT). Field Effect Transistor (FET). Operational Amplifiers.

BG2005 Biomolecular Engineering II (3 AU)
Biophysical basis of life. Metabolic pathway analysis: carbohydrate. Metabolism and catabolism. Biochemical signal transduction. Biochemical signal transduction on extracellular matrix. Biochemical system engineering.

BG2011 Computational Methods in Biomedical Engineering (4 AU)
Use of numerical methods to solve problems in science and engineering, with emphasis on biomedical engineering. Linear and non-linear algebraic equations. Optimization. Least-squares regression and interpolation. Numerical differentiation and integration. Numerical solutions of ordinary differential equations (ODE). Applications to statistical analysis. Applications to design of experiments.

BG2008 Thermodynamics (3 AU)
Thermodynamic properties and some basic concepts; volumetric properties of pure fluids; first law of thermodynamics and its application in some common processes; 2 nd law of thermodynamics and concepts of entropy; third law of thermodynamics; applications of thermodynamics in flow systems; thermodynamic property relations for systems of constant compositions; thermodynamic property relations for systems of variable compositions.

BG2009 Biomechanics (4 AU)
Body Segment Parameters, External Forces and Moments. Kinematics. Muscle and Joint Mechanics. Mechanics of Anatomical Structures and Tissues. Rheology. Cardiovascular Mechanics. Bioheat and Mass Transfer. Artificial Organs.

BG2010 Bioelectricity (4 AU)
Introduction to bioelectricity. Basics of electrical circuit analysis. Cell membrane. Ion channels and gating kinetics. Patch clamp techniques, electronics and noises. Action Potential and Hodgkin-Huxley Model. Nerve impulse and neural electrophysiology. Physiological roles of ion channels in cardioelectrophysiology, neuromuscular junction, vision and hearing.

BG2041 Mechanics of Materials (3 AU)
Concept of stress. Stress and strain. Axial loading. Torsional loading. Bending. Transformation of stress and strain. Deflection of beams. Energy methods. Columns. Shells.

BG2701 Bioengineering Laboratory 2A (1 AU)
This laboratory course aims to provide practical demonstrations and applications to reinforce theories and concepts taught in second year of Bioengineering: Biomolecular Engineering II, Thermodynamics, Fluid Systems, Mechanics of Materials, Organic Chemistry, Electronics and Anatomy and Physiology.

BG2702 Bioengineering Laboratory 2B (1 AU)
This laboratory course aims to provide appreciation and understanding of theories relating to principles in second year of Bioengineering: Biomaterials, Bioelectricity and Biomechanics.

BG3002 Control in Biosystems (4 AU)
Introduction to biomedical control systems. Biomedical control system models. Static Analysis of biomedical control systems. Time domain analysis of biomedical control systems. Frequency domain analysis of biomedical control systems. Stability analysis of biomedical control systems. Control of biomedical systems.

BG3003 Signal Processing in Biosystems (4 AU)
Nature of biomedical signals. Correlation. Impulse response. Frequency response. Continuous-time signal modeling. Discrete-time signal modeling. Noise removal and signal compensation. Stochastic signals modeling.

BG3004 Biomedical Imaging (3 AU)
Fundamentals of image and signal processing. Medical image processing techniques. X-ray imaging. Magnetic resonance imaging. Ultrasounds and ultrasonic imaging. Nuclear Imaging. Medical Radiology.

BG3005 Biomedical Instrumentation (3 AU)
Basic concepts of medical instrumentation. Quantities of measurements. Basic sensors and principles. Amplifiers and Signal processing. Data acquisition and conversion. Measuring instruments. Blood pressure measurement.

BG3006 Advanced Biocomputational Methods (4 AU)
Molecular mechanics. Molecular dynamics. Monte Carlo techniques. Application to biomolecules. Application to drug design. Introduction to density function theory.

BG2031 Biomaterials (4 AU)
Biomaterials. Ceramics, Metals and Polymers. Important Medical Applications of each Class. Implants. Biocompatibility. In-vitro and In-vivo Testing. Degradation in Biological Environment.

BG3701 Bioengineering Laboratory 3 (1 AU)
This laboratory course aims to provide practical demonstrations and applications to reinforce theories and concepts taught in third year of Bioengineering: Control, Signal Processing, Biomedical Instrumentation and Biomedical Imaging.