B.Eng. (Bioengineering)
Description of courses

Year 1 courses

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)
Introduction. 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)
Partial differentiation. Multiple integrals. Vector integral calculus. Fourier series, integrals and transforms. Partial differential equations.

BG1008 Organic Chemistry and Spectrophotometry (4 AU)
Intermediate organic chemistry course. Basic reactions of organic functional groups including alkenes, alkynes, alkyl halides, alcohols, ethers, amines, carbonyl groups and aromatic groups. Stereochemistry and spectroscopy.

BG1009 Anatomy and 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 Lab 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 Lab 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, chemistry and biomolecular engineering I.

HW110 Effective Communication (2 AU)
The communication process. Intrapersonal and interpersonal communication. Oral and written communication.

Year 2 courses

BG2004 Electronics for Biomedical Engineers (4 AU)
Introduction to electronics. Diodes. Bipolar junction Transistors (BJT) and 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.

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 carddioelectrophysiology, neuromuscular junction, vision and hearing.

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 ODE. Applications to statistical analysis. Applications to design of experiments.

BG2012 Bio-fluid Systems (4 AU)
Fluids and their properties. Pressure and head. Motion of fluid particles and streams. The momentum equation. The energy equation. 2D ideal flows. Flow in bound systems. Boundary layer. External flow and applications to biological systems.

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.

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.

BG2042 Biological Thermodynamics (3 AU)
This is an introductory course to the study of energy transformation in biological systems, the laws of thermodynamics, free energy, statistical thermodynamics, binding equilibria and reaction kinetics.

BG2701 Bioengineering Lab 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, anatomy and physiology.

BG2702 Bioengineering Lab 2B (1 AU)
This laboratory course aims to provide practical demonstrations and applications to reinforce theories and concepts taught in second year of Bioengineering: biomaterials, bioelectricity and biomechanics.

HW210 Technical Communication (2 AU)
Principles of technical communication. Conveying technical information in writing and orally. Types of technical reports. Technical writing style.

Year 3 courses

BG3002 Control in Biosystems (4 AU)
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 Bio-computational Methods (4 AU)
Molecular mechanics. molecular dynamics. Monte Carlo techniques. Application to biomolecules. Application to drug design. Introduction to density function theory.

BG3701 Bioengineering Lab 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.

Year 4 courses

BG4901 Engineers & Society (3 AU)
Evolution of modern Singapore. Technology and society. Ethics and professionalism. The environment.

BG4902 Human Resource Management (3 AU)
Strategic human resource management. Human resource planning. Job analysis, job design and quality of work life. Recruiting human resource. Employee selection. Appraising and managing performance. Human resource development / career planning and development. Employee compensation and benefits. Industrial relations. Employee health and safety. International human resource management.

HW310 Professional Communication (2AU)
Interpersonal communication in professional settings. Intercultural communication. Negotiating skills. Job search skills. Professional oral presentations. Working effectively in a team.