

Curriculum Structure

Study Program Requirements

Students are required to obtain a total of 30 units with all in pass grades for graduation.

Applicable to students admitted in 2019-20 and thereafter

- i) Required courses: 6 units (BMEG 5710 and BMEG 5720)
- ii) Elective courses: 24 units (Students may take **MSc Project + 6 taught courses** OR **8 taught courses**)

Total: 30 units

Curriculum Structure

Each course requires one evening class per week over a 13-week semester.

- **Required Courses (normally offering on Semester 1):**

Course code: BMEG 5710	
Course Title:	Introduction to Biomedical Engineering
Units:	3
Outline:	Definition, scope, basic principles and problems in biomedical engineering. Applications of technology to medicine and biology. Contemporary issues and roles of engineering applied to complex biological systems. Brief description of professional ethics.

Course code: BMEG 5720	
Course Title:	Basic Biomedical Science
Units:	3
Outline:	This course introduces students to the structure and function of anatomy, physiology, and chemical constituents of living systems. The course provides a system-based review of the structure and function, normal as well as abnormal, of cells, organs and systems. Emphases will be placed on those structures/functions that are important in

biomedical engineering. Case studies will also be included to introduce the importance of medical sciences related to biomedical engineering.

- Elective Courses:**

****Offering of elective taught courses are subject to needs and availability per year****

Course code: BMEG 5530	
Course Title:	Tissue Engineering
Units:	3
Outline:	This course provides an overview on the fundamental elements of tissue engineering including stem cell, extracellular matrix, biomaterials, soluble factor, drug delivery, mechanotransduction and bioreactor and recent advances in these fields. This course helps the students to understand how knowledge and techniques from biochemistry, biology, material science and various engineering disciplines can be applied to promote the advancement in tissue engineering of various physiological systems. Basic level of knowledge in biomaterials, biology and biochemistry is recommended.

Course code: BMEG5540	
Course Title:	Biophotonics
Units:	3
Outline:	Review of physical properties of light. Optical sources and detectors. Interaction between light and biological materials. Introduction to cell and tissues, DNA and protein. Photo-absorption, emission and spectroscopy. Bio-imaging principles and techniques. Modeling of light-tissue interaction. Light-activated therapy. Micro-array technology. Laser tweezers. Emerging biophotonic technologies.

Course code: BMEG 5730	
Course Title:	Medical Devices and Sensor Networks
Units:	3
Outline:	Origins of physiological signals. The mechanisms of bioelectrical, biochemical, biophysical, and biophotonic sensors. The principles of wearable medical devices for homecare and mobile health care system. Features of body sensor networks (BSN). Security issues for BSN. Multi-sensor data fusion for BSN. Wearable and

implantable sensor integration. Wearable devices and sensors for monitoring, diagnosis, therapy, spots, etc. Applications of medical devices, biosensors, and BSN.

Course code: BMEG 5750

Course Title: Medical Robotics

Units: 3

Outline: Introduction to robotics and its applications in biomedical engineering including diagnosis, surgery, and medical simulation. Classification of robot systems, forward and inverse kinematics associated to manipulator motion, robot design, control, sensing, and programming.

Course code: BMEG 5760

Course Title: BioMEMS and Bio-Nanotechnology

Units: 3

Outline: Introduction to MEMS and Nanotechnology, with focus on biomedical applications. Recent developments in BioMEMS, including micro-fluidic systems, integrated DNA analysis chips, and micro-fabricated bio-detection and cell-sorting systems. Recent advances in nanoscale biomedical applications, including AFM based bio-manipulation and bio-sensing, soft-lithography for DNA, proteins and cells, self-assembly of peptides and proteins, nanoscale drug delivery systems, and bio-nano-informatics fusion.

Course code: BMEG 5790

Course Title: Bioinformatics

Units: 3

Outline: This course covers DNA and protein bioinformatics. It introduces basic programming techniques, sequence analysis, including alignment of sequence, database search, statistical analysis, phylogenetic trees, scoring matrices, pattern recognition, clustering and structural prediction in bioinformatics.

Course code: BMEG 5820

Course Title: Virtual Medicine and Computer Aided Surgery

Units: 3

Outline: Image guided surgery, including CT base, fluoro-image, and others; non-image guided surgery. Introduction to clinical applications. Virtual reality and surgical simulation. Augmented reality and image-guided minimally invasive surgery. Use of telerobotics in surgery. Surgical navigation.

Course code: BMEG 5830

Course Title: Medical Imaging

Units: 3

Outline: The course introduces various diagnostic medical imaging modalities, such as projection radiography, conventional X-ray, computerized tomography (CT), nuclear medicine (PET and SPECT), ultrasound, and magnetic resonance imaging (MRI). Each of these modalities will be introduced from basic physical principles to the process of image formation. This course also reviews the basic signal processing techniques. Image processing and analysis will be introduced.

Course code: BMEG 5840

Course Title: Biomedical Engineering Laboratories

Units: 3

Outline: This course aims to provide students from different science & engineering backgrounds opportunities to learn how to fabricate simple medical materials and devices, how to collect data on human subjects and other biological samples, and how to analyze the results to address various health-related issues. The course starts with a series of lectures on the principles underpinning each of the planned laboratory modules. Students will then form teams to conduct a number of hand-on laboratory modules in different areas of biomedical engineering to achieve the course aims and learning outcomes. Examples of laboratory modules include fabrication of basic biomedical device for biosignal acquisition, advanced electrophysiological techniques, fabrication of biomaterials for drug deliveries, PCR and gel electrophoresis, confocal fluorescence microscopy, functional MRI data processing, biomedical imaging for musculoskeletal applications, measurement of interfacial pressure at body support surfaces, electromyography & exoskeleton hand robot, etc.

Course code: BMEG 5850	
Course Title:	Medical Device Regulatory Affairs and Intellectual Property
Units:	3
Outline:	This course provides an overview on medical device regulation and intellectual property. Regulatory affairs is how to get a medical product registered in different countries' health authorities. A registered product would demand a lot of technical documentation to prove its efficacy, safety, and quality. To successfully and smoothly register a product, knowledge and skills are required to deal with various key stakeholders in governments, testing centers, hospitals, and medical doctors. Intellectual Property, such as patent, is to protect the invention and to support licensing their rights to manufacturers in the medical device industry.

Course code: BMEG 5860	
Course Title:	E-Health Technologies
Units:	3
Outline:	Concepts of tele-medicine, E-medicine, and M-health. Basic techniques in tele-medicine and M-health: communication systems and networks, medical devices, E-medical records, information security and confidentiality, medical data coding and compression, functions of PACS and HIS. Applications include: tele-surgery, tele-geriatrics, tele-monitoring and M-health etc.

Course code: BMEG 5910	
Course Title:	MSc Project
Units:	6 units (2 semester)
Outline:	The objective of this course is for students to get hands-on practical experience. Each student is required to design, simulate or test a medical device/algorithm/bioinformatics database.

- Elective Courses offered by specified group**

Remarks: Students are allowed to take up TWO elective courses from below list of specified group; subject to approval of Divisions/Units concerned.

Courses offered by School of Life Sciences

For more details and latest information, please visit the website at
<http://www.bch.cuhk.edu.hk/msc/>.

Course code:	BBMS 5100
Course Title:	Perspectives in Biochemical Sciences
Units:	3
Outline:	This course presents the latest developments and advancements in biochemical sciences as well as the current topics in the society. It aims to alert students the trends and recent breakthrough in biochemistry in medical research. Issues such as stem cell research and infectious diseases shall be examined in this course.
Course code:	BBMS 5120
Course Title:	Biochemical Genetics and Forensic Sciences
Units:	3
	The first part of the lecture covered in this course includes principles of genetics at the molecular level, biochemical nature of hereditary materials, genetic codes, regulatory mechanisms, molecular basis of mutation, and DNA replication and recombination. The second part of the lecture covers collection and processing of biological samples from crime scenes, DNA analysis using RFLP and PCR-STR typing methods, interpretation of DNA typing results, and court presentation of such biological evidence. Mitochondrial DNA typing and Y chromosome DNA typing will also be discussed.
Course code:	BBMS 5200
Course Title:	Biochemical Technology I
Units:	3
	This course is designed to acquaint students with the field of biochemical technology. It begins with an introduction to the principles of transgenic animal technology, mammalian cell culture technology and reproductive biotechnology. The course also covers the contemporary applications of biochemical technology in DNA sequencing and genome mapping, RNA biology and technology, drug discovery and development. In addition, the recent advances in stem cell research, forensic DNA analysis, and authentication of Chinese medicinal materials will also be discussed.

Course code:	BBMS 5220
Course Title:	Biochemical Technology II
Units:	3
	<p>This course is an extension of the other course “BBMS5200 Biochemical Technology I”. It begins with an introduction to the basic principles of recombinant DNA technology and medical biotechnology. Modern approaches to identify and characterize cellular proteins will be introduced. Contemporary application of computing skills in data mining for biotechnological studies will also be discussed. Specifically, it includes the use of computational softwares and databases for DNA and protein sequence analysis. Based on these technologies, bioengineering of proteins (e.g. enzymes and antibodies) which are of medical and industrial importance will be illustrated. The application of x-ray crystallography in protein structural studies will also be introduced.</p>
Course code:	BBMS 6100
Course Title:	Biochemistry and Public Health
Units:	3
	<p>This course is concerned with the biochemical impacts in environment and food as they relate to public health. Attention is given to different approaches to pest control, water management, sewage management and treatment, and pollution from hazardous biochemicals and chemicals. Food additives, biochemical, chemical and microbial contaminants, and naturally occurring toxins associated with foods will also be discussed.</p>
Course code:	BBMS 6120
Course Title:	Clinical Biochemistry and Diseases
Units:	3
	<p>This course provides students with an introduction to the normal pathways of carbohydrate, lipid, nucleotide and amino acid metabolism. The course will outline the biochemical mechanisms for controlling these pathways under different physiological and nutritional conditions and discuss the importance of diseases arising from defects in these pathways. Particular emphasis will be placed on the biochemical mechanisms concerning the etiology, symptoms and treatment of diseases such as diabetes mellitus, atherosclerosis and other lipid disorders, inborn errors of carbohydrates and amino acid metabolism. Also, how biochemical test results are utilized for the diagnosis and monitoring of diseases are described.</p>

Course code:	BBMS 6200
Course Title:	Methods in Biochemistry
Units:	3
	<p>This course will allow students to gain theoretical and practical, hands-on knowledge of various advanced research methodologies and their applications in biochemical research and pre-clinical services. Methods include:</p> <ul style="list-style-type: none"> ○ Polyacrylamide gel electrophoresis and Western blot analysis ○ Enzymatic assay ○ DNA electrophoresis and DNA fingerprinting ○ PCR and polymorphism analysis ○ Human cell culture and cytotoxicity assay ○ ELISA and flow cytometry ○ Bacterial transformation and test for food contamination ○ Statistical analysis of toxic chemicals in environment
Course code:	BBMS 6300
Course Title:	Management and Accreditation of Biochemical Laboratory
Units:	3
	<p>The aims of this course are to introduce basic concepts and adequate skills of laboratory management, safety and quality assurance in biochemical laboratories. Special topics such as biochemical testing and manufacturing process, good laboratory practice, laboratory accreditation, genetic testing and experimental protocols and method validation etc, will be discussed.</p>

**Research postgraduate courses offered by
Division of Biomedical Engineering**

**For more details and latest information, please visit the website at
<http://www.bme.cuhk.edu.hk/new/mphil-phd.php>**

Course code:	BMEG 5140
Course Title:	Rehabilitation Engineering
Units:	3
Outline:	The disabling process. Aging and disabilities. Congenital disabilities. The enabling process. Therapeutic equipment in rehabilitation medicine. Assistive technologies for

	persons with physical disabilities. Assistive technologies for persons with sensory disorders, Assistive technologies for persons with communication disorders. Assistive technologies for persons with mental disabilities. Assistive technologies for learning. Assistive technology for work. Assistive technologies for leisure. Accessible technology and universal design. Appropriate technology for the developing regions.
Course code:	BMEG 5210
Course Title:	Medical Visualization
Units:	3
Outline:	Visualization uses computer-generated graphics to visually analyse very complex data and communicate ideas. Medical visualization has become a very powerful tool in computer assisted diagnosis, treatment and surgery. This course will introduce the techniques used in medical visualization. Topics will include image analysis for medical visualization, algorithms of medical visualization, as well as their applications in anatomy education, surgical simulation and image-guided surgeries.
Course code:	BMEG 5610
Course Title:	Research Methods in Biomedical Engineering
Units:	3
	This course presents research methods in biomedical engineering, and primarily aims at preparing postgraduate students for basic research or employment in the clinic and biomedical industries. Students will learn relevant concepts and tools for analyzing data arising from quantitative and qualitative research in molecular, physiological, and clinical systems. This course focuses on developing students' ability to analyze research data and critique the scientific literature.

Research postgraduate courses offered by Engineering Faculty	
Course code:	ENGG 5404
Course Title:	Micromachining and Microelectromechanical Systems
Units:	3
Outline:	Broad overview of microfabrication and microelectromechanical systems. Introduction to basic micromachining techniques such as photolithography, isotropic and anisotropic wet etching, dry etching, physical and chemical vapor deposition,

	electroplating, metrology, statistical design of experiments, MEMS release etching, stiction, and MEMS device testing. Review of MEMS microsensors, microactuators and microstructures. Topics include accelerometers, pressure sensor, optical switches, cantilever beams, thin-film stress test structures and bulk micromachining test structures. Fundamentals of central dogma of molecular biology, cell and tissue biology. Principles of transduction and measurements of molecules, cells and tissues.
Course code:	ENGG 5601
Course Title:	Principles of Biomechanics and Biomaterials
Units:	3
	Biomechanics: biostatics, biodynamics, mechanics of biological solids. Biomaterials: metals, ceramics, synthetic polymers, natural polymers, composites; characterization of biomaterials; biomaterial scaffolds for regenerative medicine. Clinical applications in the musculoskeletal system, (including, sports, traumatology, and rehabilitation), cardiovascular system, and dentistry.

CMSC / ECLT / ELEG / IEMS / MAEG / SEEM 57xx-59xx Courses offered by other M.Sc. Programme from Divisions within the Engineering Faculty.

For more details, please visit the website at <http://www.erg.cuhk.edu.hk/>.

Undergraduate courses offered by Department of Biomedical Engineering

Course code:	BMEG 4103 / 4220 / 4330 / 4510 / 4520 / 4540
Remark:	The University allows MSc students to take at most 15% of the course unit requirement at undergraduate level, which means, among the 24 units, at most 3 units can be at undergraduate level.

Course and Unit Exemptions

As stipulated in the Policy on Course and Unit Exemptions for Postgraduate Students, the total number of units exempted may not exceed half of the required number.

Courses completed in undergraduate programmes may also be considered. However, only up to 15% of the total units required for graduation may be exempted by using undergraduate courses;

Details please refer <https://www.gs.cuhk.edu.hk/download/VI-C.htm>