Course Code : BMEG5130

Course Title : Biomedical Imaging Processing

Units : 3

The course introduces advanced theories, algorithms and techniques on biomedical image processing and analysis. The course content covers compressive sensing for MRI and Terahertz imaging, biomedical image reconstruction, sample characterization methods in reflection and transmission geometry, image interpolation, image deconvolution, image segmentation, and image registration. It also includes some biomedical image applications, such as Terahertz spectroscopy and diffusion tensor MRI. Students who take this course need background on signal processing and MATLAB programming.

Course Code : BMEG5140

Course Title : Gerontechnology and Rehabilitation Engineering

Units : 3

The course begins with a review on the processes of congenital disorder, aging, degeneration and cognitive impairment. It then presents current concepts and techniques available for rehabilitation medicine and therapeutic equipment. Other topics include understanding the use of Information and Communication Technology among older adults, assistive technologies for addressing issues concerned with rehabilitation and improvement of living quality. Specific knowledge domains including physical disabilities, sensory disorders, communication disorders, mental disabilities, and technologies for learning, work and leisure, accessible technology and universal design. Specific to gerontechnology, general design considerations, current techniques for addressing dementia disorders, injury avoidance and mobility aids will be presented. Mental health aspects, as well as life quality, of service users and care provider in terms of burdens and their alleviation will be discussed.

Course Code : BMEG5310 – BMEG5340

Course Title : Biomedical Engineering Seminar I - IV

Units : 1

A series of seminars related to the topics of biomedical engineering are delivered by local and oversea biomedical engineering scholars and researchers. CUHK BME postgraduate students are required to attend at least six BME seminars during one semester and write two reports on their learning from two seminars, respectively.

Course Code : BMEG5610

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.

Course Code : ENGG5601

Course Title : Principles of Biomechanics and Biomaterials

Units : 3

This course focuses on 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.

Course Code : BMEG5530

Course Title : Tissue Engineering

Units : 3

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 : Bio-MEMS and Biophotonics

Units : 3

This course covers an introduction to MEMS and photonics technologies, with focus on biomedical applications. Topics include: introduction to cell and tissues, DNA and protein, recent developments in BioMEMS, micro-fluidic systems, integrated DNA analysis chips, micro-fabricated bio-detection and cell-sorting systems, interaction between light and biological materials, photoabsorption, emission and spectroscopy, bio-imaging principles and techniques, light-activated therapy, laser tweezers, and emerging MEMS and biophotonic technologies.

Course Code : BMEG5710

Course Title : Introduction to Biomedical Engineering

Units : 3

This course introduces the definition, scope, basic principles and problems in biomedical engineering. Students will learn applications of technology to medicine and biology, contemporary issues and roles of engineering applied to complex biological systems and brief description of professional ethics.

Course Code : BMEG5720

Course Title : Basic Biomedical Science

Units : 3

This course introduces students to the basic anatomy, physiology, and biochemistry of human body. The course provides a system-based review of the structure and function, normal as well as abnormal, of different organ systems. Emphases will be placed on those structures/functions that are important in biomedical engineering, especially the nervous system and the musculoskeletal system. Case studies will also be included to introduce the importance of medical sciences related to biomedical engineering.

Course Code : BMEG5730

Course Title : Medical Devices and Sensor Networks

Units : 3

This course introduces the origins of physiological signals, the mechanisms of bioelectrical, biochemical, biophysical, and biophotonic sensors. It covers the principles of wearable medical devices for homecare and mobile health care system. Students will learn 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. and applications of medical devices, biosensors, and BSN.

Course Code : BMEG5750

Course Title : Medical Robotics

Units : 3

This course covers the introduction to robotics and its applications in biomedical engineering including diagnosis, surgery, and medical simulation. Students will learn the classification of robot systems, forward and inverse kinematics associated to manipulator motion, robot design, control, sensing, and programming.

Course Code : BMEG5760

Course Title : Bioelectronics and Nanotechnology

Units : 3

This course covers the essential elements of bioelectronics and nanotechnology specific to biomedical engineering. The first part of this course (Bioelectronics) includes overview of bioelectronics, functional materials for bioelectronics, biomolecule-based transistors, electrochemical biosensors, device fabrication and characterisation, lab-on-a-chip, wearable devices, and implantable bioelectronics and bionics. The second part of this course (Nanotechnology) includes introduction to nanotechnology, nanolithography, solution-based synthesis of nano-materials, characterisation techniques, scanning probe-based biomanipulation, soft-lithography for DNA, proteins and cells, self-assembly of peptides and proteins, nanoscale drug delivery systems, and bio-nano-informatics fusion.

Course Code : BMEG5790

Course Title : Bioinformatics

Units : 3

This course covers DNA, RNA and protein bioinformatics. It introduces basic understanding into bioinformatics, biostatistics, programming techniques, sequence analysis, database search, pattern recognition, and clustering structural prediction.

Course Code : BMEG5820

Course Title : Virtual Medicine and Computer Aided Surgery

Units : 3

This course introduces the image guided surgery, including CT base, fluoro-image, and others, non-image guided surgery. It covers the introduction to clinical applications, virtual reality and surgical simulation, augmented reality, image-guided minimally invasive surgery, use of telerobotics in surgery, and surgical navigation.

Course Code : BMEG5830

Course Title : Medical Imaging

Units : 3

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 and introduces the image processing and analysis.

Course Code : BMEG5840

Course Title : Biomedical Engineering Laboratories

Units : 3

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 : BMEG5850

Course Title : Medical Device Regulatory Affairs and Intellectual Property

Units : 3

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 : BMEG5860

Course Title : E-Health Technologies

Units : 3

This course introduces the concepts of tele-medicine, electronic-medicine (E-health), and mobile-health (M-health). It covers basic techniques in tele-medicine and M-health, namely communication systems and networks, medical devices, E-medical records, information security and confidentiality, medical data coding and compression, functions of picture archiving and communication systems (PACS) and health information systems (HIS). Applications of E-health technologies, which include tele-surgery, tele-geriatrics, tele-monitoring and M-health etc, will be covered.

Course Code : BMEG 8003 / BMEG8006 / BMEG8012

Course Title : Thesis Research

Units : 3 / 6 / 12

In this course, a student is required to meet regularly with his/her supervisor individually and/or in small group, to receive guidance and supervision to conduct his/her thesis research and to write up his/her thesis.