Master of Science in Biomedical Engineering

Core Courses

1. BG6006 - Polymeric Materials for Biomedical Applications
2. BG6007 - Advanced Medical Devices and Systems
3. BG6008 - 3D Printing for Biomedical Applications
4. BG6013 - Data Analytics for Biomedical Applications

Bioanalytical and Diagnostic Technology Specialization: Prescribed Elective Courses (All 4 courses required)

1.BG6009 - Intro to Project Management for Biomed Sector
2.BG6010 - Biomedical Device Regulatory Systems
3.BG6011 - Microfluidics and Lab-On-Chip for Chemical & Biomedical Applications
4.BG6012 - In Vitro Diagnostics and Bionanotechnology

Biotechnology and Pharmaceutical Engineering Specialization Prescribed Elective Courses (All 4 courses required)

1.BG6016 - Drug Delivery and Nanomedicine
2.BG6019 - Genome Technologies
3.CM6862 - Advanced Analytical & Manufacturing Techniques in Pharmaceutical Industry
4.CH6270 - Sustainable Pharmaceutical Technology

General Elective Courses

1.BG6015 - Engineering in Mechanobiology
2.BG6017 - Biomedical Entrepreneurship
3.BG6018 - Tissue Engineering and Regenerative Medicine
4.BG6025 - Professional Internship
5.BG6023 - MSc Research I
6.BG6024 - MSc Research II

Non-compulsory courses (Non-credit bearing)

1. BG6021 - Academic Communications
2. BG6022 - Laboratory Rotation

BG6006 - Polymeric Materials for Biomedical Applications

This course will discuss advanced topics related to advanced biomaterials with a focus on soft, polymeric biomaterials for biomedical applications. Basic concepts and methodology on polymer synthesis, polymer physiochemical and biological characterization will be systematically introduced. Strategies for selection of polymer design to optimize their immuno-compatibility, biodegradability and optimal implant performance will also be illustrated via real-world clinical applications in medical devices, drug delivery, tissue engineering and consumer care.

BG6007 - Advanced Medical Devices and Systems

This course covers a broad range of technologies relevant to medicine and human health. Students will be equipped with a deeper understanding of working principles behind many common biomedical instruments, more advanced technologies including therapeutics and surgery, and cutting-edge developments such as wearables and neurotechnology. The course also covers some important fundamentals in software development that are relevant to technology deployment and user experience.

BG6008 - 3D Printing for Biomedical Applications

This course introduces 3D printing technologies including history and basic of 3D printing, currently available 3D printing methods and printable materials as well as current and emerging 3D printing for biomedical applications. Students will get a general idea on bioprinting, development to cell/stem cell printing, from organoid-based tissue organization to bioprinting of human-scale tissue structures. This course will be composed of a lecture and a hands-on laboratory session, during which students will create a 3D design and print a functional prototype.

BG6013 - Data Analytics for Biomedical Applications

This course aims to equip students with a robust understanding of data analytics principles and their specialized applications in the biomedical fi eld. By integrating statistical analysis, machine learning, and data visualization techniques, the course provides students with the tools to analyse complex biological and healthcare datasets effectively. Targeted at undergraduate and graduate students, professionals in bioengineering, and data enthusiasts with a strong interest in health-related analytics, this course is ideal for individuals seeking to bridge the gap between biomedical knowledge and data-driven decision-making. Participants will gain hands-on experience in real-world applications, such as genomic data analysis, medical imaging, and predictive modelling for patient care, using state-of-the-art software and programming languages. This course is invaluable for those aspiring to pursue careers in bioengineering related research. By the end of the course, students will be well-prepared to contribute to the rapidly evolving fi eld of biomedical data research, addressing critical challenges in personalized medicine and clinical research.

BG6009 - Intro to Project Management for Biomed Sector

This course equips students with practical project management skills through hands-on experience in planning and managing a biomedical project. Students will work on a specific project from initial concept to detailed design, applying key project management principles while addressing the unique regulatory, ethical, and interdisciplinary considerations of the biomedical field.

BG6010 - Biomedical Device Regulatory Systems

This course aims to introduce the fundamentals of medical device regulations including the principles of quality management systems, risk based regulatory principles and risk management processes. This would equip you with a better understanding of the key regulatory requirements and their role in ensuring the quality, safety and efficacy of the medical devices used in our healthcare systems. In this course, you would also be introduced to some evolving regulatory approaches being developed to regulate innovative medical technologies such as software medical devices and artificial intelligence enabled medical devices. You would learn how to apply some of these regulatory principles to medical device development process and better prepare medical devices for regulatory compliance.

BG6011 - Microfluidics and Lab-On-Chip for Chemical & Biomedical Applications

This course is designed to equip you with a comprehensive understanding of microfluidics and Lab-On-Chip technologies. You will learn the fundamental principles of microfluidic fluid mechanics, microfabrication techniques, and system integration. Throughout the course, you will explore the design and operation of essential microfluidic components such as valves, pumps, and mixers, and understand how they are applied in real-world scenarios across life sciences, chemistry, and healthcare diagnostics.

BG6012 - In-Vitro Diagnostics and Bionanotechnology

This module covers the fundamental principle of point-of-care In Vitro Diagnostic (IVD) devices and how the recent development of bionanotechnology offer new opportunities in IVD development. The design principles and functions of the components of IVD devices ranging from classical paper-based assays to recently developed wearable devices will be discussed. Commonly used signal detection mechanisms for on-site applications will be introduced for different molecular targets. A lab project to fabricate two fully functioning paper-based lateral flow assays will complete the training including preparation of the detection probes, fabrication and assembly of the devices, and quality analysis of the assays. Nanostructures with unique optical, magnetic, chemical, and structural properties will be introduced and cases studies will be analysed for their applications in the IVD field.

BG6016 - Drug Delivery and Nanomedicine

This course aims to provide a broad introduction to contemporary topics in the field of drug delivery and nanomedicine, with an emphasis on the discussions of some key concepts and principles as well as representative systems for the applications of drug delivery and nanomedicine. We will also discuss fundamental science and engineering governing the design, synthesis, properties and applications of various systems. This course will provide students an opportunity to gain knowledge, insights, skills and expertise in this field, supporting them for future careers in relevant academia and industries.

BG6019 - Genome Technologies

This course will discuss topics relevant to the reading, writing, and interpretation of genomes and transcriptomes. A genome is akin to an instruction manual for a living cell. It contains an organism's complete set of genes and all the regulatory elements that determine when and how these genes are used. Hence, a deep understanding of the genome and its encoded products is central to biomedical science and biotechnology. In this course, basic and advanced concepts of the genome and genomics will be progressively introduced. Emphasis will be placed on cutting edge high-throughput sequencing technologies, genome and transcriptome engineering technologies including CRISPR-Cas, and functional genome-wide screens.

CM6862 - Advanced Analytical & Manufacturing Techniques in Pharmaceutical Industry

This course covers the analytical and manufacturing techniques used in drug discovery and development. Topics include the drug discovery and development process, analytical techniques (high performance liquid chromatography, liquid chromatograph mass spectrometry, gas chromatography, gas chromatograph mass spectrometry), chemistry, manufacturing & controls (CMC), continuous flow chemistry and manufacturing techniques like biocatalysis and addictive manufacturing.

CH6270 - Sustainable Pharmaceutical Technology

This course aims to equip you with the latest research and development strategies to enhance the environmental sustainability of manufacturing of pharmaceuticals, including small-molecule active pharmaceutical ingredients and drug biologics (e.g., peptides, proteins). This course covers sustainability enhancement strategies in drug solubility enhancement, environmental footprints reduction, continuous manufacturing platform, and lifecycle analysis. This course will enable you to apply and implement the different approaches available for sustainability enhancement in the pharmaceutical industry.

BG6015 - Engineering in Mechanobiology

This course offers students opportunities to explore new frontiers of precision medicine in mechanobiology and learn the strategies to design and integrate engineering principles and new technologies in advancing mechanobiology. Examples in therapeutic development for cancer, cardiovascular disease, stem cell therapy, immune therapy, and tissue engineering will be discussed. Advanced technologies such as super-resolution microscopy, single molecule technologies, organ-on-a-chip, and spatial-omics will also be introduced to illustrate the importance of engineering principles and new technologies.

BG6017 - Biomedical Entrepreneurship

This course adopts a problem-based learning approach. It starts by illustrating the essential concepts and knowledge of entrepreneurship and entrepreneurial process. Participants get to appreciate and evaluate different types of entrepreneurial opportunities, challenges, risks, and uncertainty. They learn what is entrepreneurial mindset, how to develop such a mindset, and the essential skills to seize entrepreneurial opportunities. A deliberate emphasis is placed on the biomedical engineering business context and the applications. Participants need to apply the entrepreneurship knowledge and skills to address real-life entrepreneurial challenges in the biomedical engineering context.

BG6025 - Professional Internship

The Professional Internship requires you to apply the knowledge and skills you have learned to an authentic work environment, to gain exposure and develop practical industry experience and skills for your future selected vocation. That means that student get to work in a Biomedical Industry as an intern.

BG6023 - MSc Research I / BG6024 - MSc Research II

MSc research project is specifically crafted for students to work on technology development in a research setting under the guidance of a faculty member. The project is required to involve some degree of new and original research, not just a review of previous work. Conducting relevant research provides students with opportunities to further apply the theoretical knowledge and analytical skills developed in the courses taken.

BG6018 - Tissue Engineering and Regenerative Medicine

Tissue Engineering and Regenerative Medicine are closely related fields in biomedical science aimed at repairing, replacing, or regenerating damaged tissues or organs.

BG6021 - Academic Communications

The objective of this course is to help graduate students develop their written and oral communication skills in English in academic settings. The main goals of the course are to equip students with the necessary knowledge to write a publishable academic paper, as well as present their scientific knowledge and findings to both specialists and lay audiences. This course is a non-credit bearing core course and will be part of co-curricular learning course.

BG6022 - Laboratory Rotation

This course offers students in the Master of Science-Biomedical Engineering (MScBME) the opportunity to engage in research activities under the guidance of faculty members within the School of Chemistry, Chemical Engineering and Biotechnology (CCEB). Students are expected to take two 5-week laboratory rotations with two different faculty members of the school. Designed as an introductory research immersion experience, its primary aim is to familiarize students with different sub-disciplines and techniques related to their main interest, as well as fundamental protocols and techniques employed in academic research laboratories. This course is a non-credit bearing core course and will be part of co-curricular learning course.