Master of Science in Biomedical Engineering

Core Courses
1.BG6001 Advanced Biomaterials (3 AU)
2.BG6003 Advanced Biomedical Instrumentation (3 AU)
3.BG6008 3D Printing for Biomedical Applications (3 AU)
4.BG6013 Data Analytics for Biomedical Applications (3 AU)
5.Academic Communications (0 AU)
6.Laboratory Rotation (0 AU)
7.Research Sharing & Journal Club (0 AU)

Bioanalytical and Diagnostic Technology Specialization: Prescribed Elective Courses (3 courses required)
1.BG6011 Microfluidics and Lab-On-Chip for Chemical & Biomedical Applications (3 AU)
2.BG6012 In Vitro Diagnostics and Bionanotechnology (3 AU)
3.BG6009 Introduction to Project Management in the Health and Biomedical Sector (3 AU)
4. BG6010 Biomedical Device Regulatory Systems (3 AU)

Biotechnology and Pharmaceutical Engineering Specialization Prescribed Elective Courses (3 course required)
1.BG6018 Genome Technologies (3 AU)
2.BG6016 Drug Delivery and Nanomedicine (3 AU)
3. CH6270 Sustainable Pharmaceutical Technology (3 AU)
4.CM6862 Advanced Analytical & Manufacturing Techniques in Pharmaceutical Industry (3 AU)

General Elective Courses
1.BG6015 Engineering in Mechanobiology (3 AU)
2.BG6017 Biomedical Entrepreneurship (3 AU)
3.BG6018 Tissue Engineering and Regenerative Medicine (3 AU)
4.BG6007 MSc Research I (3 AU)
5.BG6008 MSc Research II (3 AU)
6.BG6006 Professional Internship (3 AU)

BG6001 Advanced Biomaterials

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.

BG6003 Advanced Biomedical Instrumentation

This course will discuss advanced areas of biomedical instrumentation. basic electronics, prototyping (CAD tool), advanced medical instrumentation like pacemaker, defibrillator, advanced imaging instrumentation.

BG6006 Professional Internship

Professional Internship is offered as an entrepreneurship elective course in semester 2. 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.

BG6007 MSc Research Project I / BG6008 MSc Research II

MSc research project is specifically crafted for students to work on technology development in 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.

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 organisation 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.

BG6009 Introduction to Project Management in the Health and Biomedical Sector

This course aims to provide an overview on the process of medical device development. The course project will take students to go through the process of finding an urgent clinical need and developing a proper solution with validation.

BG6010 Biomedical Device Regulatory Systems

This will be the focus of this lab-based course on instrumentation. This course is open to students who have the related background, and your expertise will be combined to realize in practice an equipment with biomedical focus. Teams will be composed of students from the different disciplines and learning is based on project. As an interdisciplinary field of study, students can learn about chemistry, physics, biology, and engineering. So, if you have a passion to learn applied biomedical instrument techniques, then not only is this course perfect for you but it is also your steppingstone to excellent job opportunities and advancement prospects.

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

This course will cover fundamentals of microfluidic and Lab-On-Chip technology, including the basic fluid mechanics theory, microfabrication for microfluidics, microfluidic flow control and system development. Function of microfluidics components, such as valves, pumps and mixers will be explained in details. Applications of microfluidics and Lab-On-Chip will be highlighted by introducing the microfluidic components for life sciences, chemistry, point-of-care diagnostics, Organ-on-Chip and so on. Through assignment, students will have the chance to research a particular type of microfluidic technology and its utility for specific applications.

BG6012 In Vitro Diagnostic and Bionanotechnology

This course 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.

BG6013 Data Analytics for Biomedical Applications

Course content include:

1. Introduction to data science and its applications in real-world problems
2. Data Exploration, Data Cleaning and Pre-Processing
3. Introduction of Statistic in Data Analysis
4. Data Mining
5. Machine learning in data science
6. Basic Python Programming
7. Data science using Python in Jupyter notebook
8. Machine Learning Approach #1: Linear Regression
9. Machine Learning Approach #2: Classification
10. Machine Learning Approach #3: Clustering
11. Machine Learning Approach #4: Anomaly Detection
12. Application of algorithms from the above four approaches on real data using python in Jupyter notebook
13. Visualization
14. Data analytics on real data from biomedical applications using
15. Python in Jupyter notebook

BG6014 MedTech Entrepreneurship: Driving Medical Technology to Impactful Venture

This course provides aspiring MedTech innovators / entrepreneurs with fundamental knowhow towards a clear commercialization pathway through an integrated product and business development approach, targeting medtech-specific business model planning, product design and regulatory strategy. This course is ideal for prestart-up or start-up entrepreneurs, or individuals wishing to understand the business and regulatory landscape of medtech venture.

BG6015 Engineering in Mechanobiology

In this course, we will introduce the basic concepts in mechanobiology, and the physiological and pathological conditions related. A portion of the course will discuss the technology and engineering designs used in mechanobiology studies.

BG6016 Drug Delivery and Nanomedicine

Drug delivery technologies produce formulations of small molecules and biologics that target the payloads to the sites of interest for a desired therapeutic outcome. This course covers the formulation platforms, drug administration and metabolism, biological barriers, and targeting strategies for different diseases. It will also introduce recent advances in vaccine development and immunotherapy. Recent development in nanotechnology offers new possibilities of nanomedicine formulations of drug candidates and integrating multiple therapeutic modalities in the single formulation for synergistic treatment effects. This course will also summarize nanomedicine commercialized and under evaluations and discuss the current challenges and future perspectives.

CH6001 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 is intended to equip graduate students with the awareness and knowledge of the overall analytical and manufacturing techniques in both the drug discovery and development, and the pharmaceutical industries. Besides the overall drug discovery and development process, other topics include analytical techniques (high performance liquid chromatography, liquid chromatograph mass spectroscopy, gas chromatography, manufacturing & controls (CMC, continuous flow chemistry and manufacturing techniques like biocatalysis and addictive manufacturing.