BIOMEDICAL ENGINEERING (BMG)

Courses in biomedical engineering (BMG) are offered by the Faculty of Engineering

BMG 5001 Stage en génie clinique / Clinical Engineering Internship (6 crédits / 6 units)

Stage en génie clinique dans un établissement extérieur à l'université. Rédaction d'un rapport ayant trait aux activités menées durant l'internat. Noté S (satisfaisant) ou NS (non satisfaisant) par le superviseur et un professeur nommé par le directeur du programme. / Internship in an institutional setting outside the university. Requires a formal written paper relating to the internship activities. Graded S (Satisfactory) / NS (Not satisfactory) by the supervisor and a professor appointed by the program director. Préalable : approbation du directeur du programme. / Prerequisite: approval of the program director. Ce cours est équivalent à BIOM 5801 à la Carleton University. / This course is equivalent to BIOM 5801 at Carleton University.

Volet / Course Component: Stage / Work Term

Préalable: approbation du directeur de programme. / Prerequisite: approval of the program director.

BMG 5103 Biomedical Instrumentation (3 units)

Instrumentation designed to measure physiological variables related to the function of the heart, lungs, kidney, nervous and musculo-skeletal systems; emergency, critical care, surgery and anesthesia equipment. This course is equivalent to BIOM 5100 at Carleton University.

Course Component: Lecture

Courses BMG 5103, ELG 6320 cannot be combined for units.

BMG 5104 Biological Signals (3 units)

Modeling of neuromuscular biological signals, including subthreshold phenomena, active behaviour of cell membranes, and innervation processes. Measurement of biological signals, including electrode effects. Time domain, frequency domain, and adaptive filtering techniques for noise reduction. This course is equivalent to BIOM 5101 at Carleton University.

Course Component: Lecture

BMG 5105 Medical Imaging Modalities (3 units)

Mathematical models of image formation based on the image modality and tissue properties. Linear models of image degradation and reconstruction. Inverse problems, regularization for image reconstruction. Image formation in radiology, computed tomography, MRI, nuclear medicine, ultrasound, positron emission tomography. This course is equivalent to BIOM 5200 at Carleton University.

Course Component: Lecture

Courses BMG 5105, ELG 5127 cannot be combined for units.

BMG 5106 Introduction to Medical Imaging Principles and Technology (3 units)

Basic principles and technological implementation of x-ray, nuclear medicine, magnetic resonance imaging (MRI), and other imaging modalities used in medicine; contrast, resolution, storage requirements for digital images; applications outside medicine, future trends. This course is equivalent to BIOM 5201 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5107 Applications in Biomedical Image Processing (3 units)

Image processing methods applied to biomedical images. Overview of medical imaging modalities. Image enhancement, segmentation, registration, and fusion. Image quality metrics. Image formats. Application examples. Includes: Experiential Learning Activity This course is equivalent to BIOM 5202 at Carleton University.

Course Component: Lecture

BMG 5108 Advanced Topics in Biomedical Image Processing (3 units)

Recent and advanced topics in the field of biomedical image processing and its related areas. Prerequisite: permission of the program director. This course is equivalent to BIOM 5203 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5109 Advanced Topics in Medical Instrumentation (3 units)

Recent and advanced topics in the field of medical instrumentation and its related areas. This course is equivalent to BIOM 5106 at Carleton University.

Course Component: Lecture

BMG 5110 Advanced Topics in Biomechanics and Biomaterials (3 units)

Recent and advanced topics in the field of biomechanics and biomaterials and its related areas. This course is equivalent to BIOM 5304 at Carleton University.

Course Component: Lecture

BMG 5111 Advanced Topics II Medical Informatics and Telemedicine (3 units)

Recent and advanced topics in the field of medical informatics and telemedicine and its related areas. This course is equivalent to BIOM 5403 at Carleton University.

Course Component: Lecture

BMG 5112 Introduction to Biomedical Engineering (3 units)

Research ethics and methods. Engineering systems approach to analysis and modelling of human anatomy and physiology. Introduction to topics including biomechanics, electrophysiology, and computational biology. Biomedical technologies. Impact of technology on society. This course is equivalent to BIOM 5010 at Carleton University.

Course Component: Lecture

BMG 5113 Clinical Engineering (3 units)

Overview of the Canadian health care system; brief examples from other countries; clinical engineering and the management of technologies in industrialized and in developing countries; safety, reliability, quality assurance; introduction to biomedical sensor technologies; applications of telemedicine; impact of technology on health care. This course is equivalent to BIOM 5406 at Carleton University.

Course Component: Lecture

BMG 5120 Biomechanics of Movement (3 units)

Human and animal movement examined through the lens of mechanics. Biological, mechanical, and neurological processes by which muscles produce movement. Experimental, mathematical, and computational tools. Clinical and sports applications. Recent advances in biomedical research. Assignments, computer simulations, and a small research project.

Course Component: Lecture

The courses BMG 5120, MCG 4153, and MCG 4553 cannot be combined for units.

BMG 5122 Biomaterials and Tissue Engineering: Theories and Applications (3 units)

This course covers principles of materials science and cell biology that apply to biomaterials and tissue engineering. Polymers, ceramics, metals, biomaterial surface modifications, molecular and cellular interactions with biomaterials, immune response, tissue engineering principles, ethical considerations and regulatory overview. Technical analysis of a biomaterial-based medical device.

Course Component: Lecture

The courses BMG 5122, MCG 4154, and MCG 4554 cannot be combined for units.

BMG 5130 Fundamentals of Policy I: Policy Analysis (3 units)

Policy analysis and policy processes with an emphasis on the stages of the policy process, as well as the influences of institutions, ideas and interests. This course is equivalent to HLTH 5201 at Carleton University.

Course Component: Lecture

BMG 5300 Biological and Engineering Materials (3 units)

Properties of structural biological materials (bone, tendon, ligament, skin, cartilage, muscle, and blood vessels) from an engineering materials viewpoint. Selection of engineering materials as biomaterials. Introduction to biocompatibility. Histology of soft tissues. Viscoelasticity, mechanical properties and models of muscles, ligaments and tendons. This course is equivalent to BIOM 5300 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5301 Biomechanics of Skeletal System, Motion and Tissue (3 units)

Analysis of human motion. Kinematics and kinetics of various activities. Engineering analysis and modeling techniques applied to human motion. Injury mechanics, treatment, prosthetic replacements. Fracture behaviour and healing processes. This course is equivalent to BIOM 5301 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5302 Biofluid Mechanics (3 units)

Properties of blood. Blood flow models for vessels, circulation systems and the heart. Man-made blood vessels. Kidney flow and exchange. Modeling of perfused tissues and cells. Transport phenomena across membranes. Molecular and ionic transport. Other body fluids. This course is equivalent to BIOM 5302 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5304 Interactive Networked Systems and Telemedicine (3 units)

Telemanipulator; human motoring and sensory capabilities; typical interface devices; mathematical model of haptic interfaces; haptic rendering; stability and transparency; remote control schemes; time delay compensation; networking and real-time protocols, history and challenges of telemedicine; telemedicine applications: telesurgery, tele-monitoring, tele-diagnosis and tele-homecare. This course is equivalent to BIOM 5402 at Carleton University.

Course Component: Lecture

Courses BMG 5304 ad ELG 6133 cannot be combined for units.

BMG 5305 Pattern Classification and Experiment Design (3 units)

Introduction to a variety of supervised and unsupervised pattern classification techniques with emphasis on correct application. Statistically rigorous experimental design and reporting of performance results. Case studies will be drawn from various fields including biomedical informatics. This course is equivalent to BIOM 5405 at Carleton University.

Course Component: Lecture

Courses BMG 5305 and ELG 6102 cannot be combined for units.

BMG 5306 Special Topics in Mechanical and Aerospace Engineering: Biomechanics (3 units)

Overview of human anatomy and physiology with emphasis on artificial organ and prosthetic device design requirements. Application of engineering principles to cells and tissues, biofluid mechanics, human body energetics, measurement techniques, mechanics of human body systems, with emphasis on the artificial heart. This course is equivalent to BIOM 5306 at Carleton University.

Course Component: Lecture

The courses BMG 5306 and MCG 5489 cannot be combined for units.

BMG 5311 Design of Medical Devices and Implants (3 units)

Solutions to clinical problems through the use of implants and medical devices. Pathology of organ failure and bioengineering and clinical aspects of artificial organs. Examples: blood substitutes, pacemakers, ventricular assist devices, artificial hearts and heart valves. This course is equivalent to BIOM 5311 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5312 Design of Orthopaedic Implants and Prostheses (3 units)

Anatomy of the musculo-skeletal system. Electromyography. Static and dynamic analysis of the human skeleton. Materials and manufacturing considerations for orthopaedic devices. Strength and failure theories. Implant fatigue, fracture and corrosion. This course is equivalent to BIOM 5312 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5315 Biorobotics (3 units)

Interpretation of physical laws as applied to human motion; kinematics and dynamics of humanoid robots, modeling of biological sensors and actuators, artificial muscles, tele-manipulation, dual arm robots, robot-assisted surgery, and multi-fingered end-effectors. Approaches to design of mechatronic devices to support and enhance human movement including rehabilitators, extenders, haptic devices, and minimally invasive surgery systems. This course is equivalent to BIOM 5315 at Carleton University.

Course Component: Lecture

Permission of the Department is required.

BMG 5319 Introduction to Microfluidics (3 units)

Physics of liquid transport in micro-fabricated systems including physics at the microscale, hydrodynamics of microfluidic systems, diffusion mixing, introduction to microfabrication, examples of microfluidics devices and Micro PIV techniques, project.

Course Component: Lecture

The courses BMG 5319, MCG 4112, and MCG 4512 cannot be combined for units.

BMG 5330 Electromagnetic Fields and Biological Systems (3 units)

Review of electromagnetic waves at radio and microwave frequencies. Electrical and magnetic properties of tissue. Impact of electromagnetic waves on tissue. Cellular effects. This course is equivalent to BIOM 5330 at Carleton University.

Course Component: Lecture

Prerequisite: knowledge of electromagnetic theory.

BMG 5501 Étude technique et modélisation de l'anatomie et de la physiologie du corps humain (3 crédits)

Méthodes de systèmes d'ingénierie pour analyser et modeler les systèmes anatomiques et physiologiques du corps humain. Propriétés mécaniques et électriques des tissus. Systèmes musculosquelettiques, cardiovasculaires et pulmonaires. Ce cours est équivalent à BIOM 5001 à la Carleton University.

Volet : Cours magistral

BMG 5502 Éthiques, normes et méthodes de recherche (3 crédits)

Théories éthiques, prise de décision, codes de déontologie; expérimentation sur des animaux et des êtres humains, consentement, comités de déontologie; méthodes de recherche et règlements concernant la conception, la fabrication et la certification d'appareils médicaux; collecte, contrôle et analyse des données, y compris la protection de la confidentialité, dilemmes bioéthiques, effets (sociaux, politiques, financiers) de la technologie et de la recherche. Les cours ELG 7514/EACJ 5300, BMG 5502 ne peuvent être combinés pour l'obtention de crédits. Ce cours est équivalent à BIOM 5002 à la Carleton University.

Volet : Cours magistral

BMG 6000 Projet en génie biomédical / Biomedical Engineering Project (6 crédits / 6 units)

Projet en génie biomédical supervisé par un professeur approuvé par le directeur du programme. Rédaction d'un rapport approfondi, qui doit être présenté oralement. Noté S (satisfaisant) ou NS (non satisfaisant) par le superviseur du projet et un autre professeur nommé par le directeur du programme. Le projet peut normalement être complété en une session d'études à temps complet. Ce cours est équivalent à BIOM 5900 à la Carleton University. / Project in biomedical engineering supervised by a professor approved by the program director. Requires an in-depth report that must be presented orally. Graded S (Satisfactory) or NS (Not satisfactory) by the supervisor and by another professor appointed by the program director. The project can normally be completed in one session of full-time study. This course is equivalent to BIOM 5900 at Carleton University.

Volet / Course Component: Recherche / Research

Permission of the Department is required.

BMG 6001 Projet en génie clinique / Clinical Engineering Project (6 crédits / 6 units)

Projet en génie clinique supervisé par un professeur du programme et un ingénieur clinique. Rédaction et présentation orale d'un rapport approfondi. Noté S (satisfaisant) ou NS (non satisfaisant) par les superviseurs du projet et un autre professeur nommé par le directeur du programme. Le projet peut normalement être complété en une session d'études à temps complet. Ce cours est équivalent à BIOM 5901 à la Carleton University. / Project in clinical engineering supervised by a professor in the program and a clinical engineer. Requires an in-depth report that must be presented orally. Graded S (Satisfactory) or NS (Not satisfactory) by the co-supervisors and by another professor appointed by the program director. The project can normally be completed in one session of full-time study. This course is equivalent to BIOM 5901 at Carleton University.

Volet / Course Component: Recherche / Research

Permission of the Department is required.

BMG 6996 Séminaire en génie biomédical / Biomedical Engineering Seminar

Cours composé d'une série de séminaires présentés par des étudiants de deuxième cycle et des chercheurs en génie biomédical. En plus d'avoir à animer un séminaire, tous les étudiants doivent assister à au moins dix séances. Ce cours est équivalent à BIOM 5800 à Carleton University. / This course is in the form of seminars presented by graduate students and other researchers in the area of Biomedical Engineering. To complete this course, a student must attend at least ten seminars and make one presentation in the context of this seminar series. This course is equivalent to BIOM 5800 at Carleton University.

Volet / Course Component: Séminaire / Seminar

BMG 7199 Directed Studies in Biomedical Engineering (3 units)

Various possibilities exist for pursuing directed studies on topics approved by a course supervisor, including the above-listed course topics where they are not offered on a formal basis.This course is equivalent to BIOM 5906 at Carleton University.

Course Component: Research

BMG 9901 Séminaire de doctorat en génie biomédical / Biomedical Engineering PhD Seminar

Une série de séminaires présentés par des étudiants aux cycles supérieurs et des chercheurs invités. En plus d'avoir à présenter deux séminaires, les étudiants doivent assister et participer à au moins 20 séminaires. Noté S (satisfaisant) ou NS (non satisfaisant). Ce cours est équivalent à BIOM 6800 à Carleton University. / This course is in the form of seminars presented by graduate students and other researchers in the area of Biomedical Engineering. To complete this course, a Student must attend at least 20 seminars and make two presentations in the context of this seminar series. This course is equivalent to BIOM 6800 at Carleton University.

Volet / Course Component: Séminaire / Seminar

BMG 9997 Rapport et soutenance du projet de thèse / Report and Defence of Thesis Proposal

Inscription requise de tous les candidats au doctorat jusqu'à la réussite à l'examen de synthèse. / Following completion of the comprehensive examination, registration required for all PhD candidates until the thesis proposal is accepted by the Advisory Committee

Volet / Course Component: Recherche / Research

BMG 9998 Examen de synthèse / PhD Comprehensive Exam

À la suite de la réussite à l'examen de synthèse, inscription requise de tous les candidats au doctorat jusqu'à ce que le projet de thèse soit accepté par le Comité consultatif. / Registration required for all PhD candidates until the comprehensive examination is passed.

Volet / Course Component: Recherche / Research