WINTER 2025 TEACHING ASSISTANT POSITIONS

Course	Time per term	Course Description/TA skills
BMEG 101	72h for each of three TAs in Term 2	**Introduction to Biomedical Engineering** Foundational material spanning many specializations of the BMEG undergraduate program. Topics include: sensors and instrumentation; biosignals; physiological modeling; biomechanics; biomaterials; cellular engineering; regenerative medicine; and engineering design in these contexts.
BMEG 102	72h for each of eight TAs in Term 2	**Biomedical Engineering Lab**. Rapid prototyping of mechanical, electrical and electromechanical systems. Building parts with state-of-the-art software and 3-D printing. Use of laboratory equipment and instrumentation
BMEG 201	90h for each of two TAs in Term 2	**Technical Communication for Biomedical Engineers** Report preparation, business correspondence, and oral presentation in biomedical engineering specific cases and projects
BMEG 210	36h for each of four TAs in Term 1	**Thermodynamics in Biomedical Engineering** Work, heat and energy; material and energy balances; the first law and second law of thermodynamics; entropy and process reversibility; availability (energy) analysis; Hess's Law; thermodynamic properties of fluids; and applications to biomedical systems

BMEG 220	35h for each of two TAs in Term 2 80h for each of two TAs in Term 2	**Circuits and Electromagnetics with Application to Biomedical Engineering** Electromagnetic phenomena in the body; bioinstrumentation; electrostatic and electromagnetic fields, forces, capacitance and inductance; bio-effects of electromagnetic fields; and modelling electrical components of physiological and biomedical systems. Preferred skills/knowledge for this position: a strong background in electromagnetics and circuits, MATLAB coding, bioinstrumentation, and medical devices
BMEG 230	96h for each of four TAs in Term 1 96h for one STA in Term 1	**BMEG 230 – Biomechanics I** Integrating the study of two-dimensional movement of animals and humans with the study of the manner in which forces on biomechanical structures such as bones, ligaments, tendons, muscles and joints cause motion. Techniques of solid mechanics and two-dimensional rigid body dynamics. Preferred skills/knowledge for this position: Strong background in statics, dynamics and solid mechanics is required; basic familiarity with Musculo-skeletal anatomy is required; familiarity with Matlab and Solidworks and biomechanical equipment (accelerometers, EMG, motion tracking, force plates) is an asset
BMEG 245	72h for each of six TAs in Term 1	**The Fundamental Units of Life: From Cells To Systems** The structure and function of cells and how they are organized to generate tissues and organ systems. Preferred skills/knowledge for this position: Requires experience with: gel electrophoresis, confocal microscopy, and a basic molecular biology technique such as running DNA gel, restriction digestion of plasmid and sequence analysis using online tools and software

BMEG 250	72h for each of three TAs in Term 2	**Cellular Physiology and Biophysics** Cellular structure and mechanisms of membrane transport, signal transduction, muscle mechanochemistry and neurotransmission. Structure and hierarchical organization up to the level of tissues. Light and electron microscopy
BMEG 257	90h for each of four TAs in Term 2	**Biomedical Engineering Design I** Engineering design process for biomedical technologies. Practical skills in engineering design, computer aided design, electronic circuits, programming, and rapid prototyping in the context of biomedical technologies. Introduction to broader ethical and sustainability considerations for biomedical technology design
BMEG 310	72h for each of two TAs in Term 1 54h for each of four TAs in Term 1	**Introduction to Bioinformatics** Principles behind the methods of bioinformatics. The use of bioinformatics databases and tools for solving problems in genomics, proteomics, structural biology and evolutionary biology. Preferred skills/knowledge for this position: Experience with R, including some or all of: machine learning, PCA, clustering, bioinformatics, bioconductor, gene expression analysis, gene set enrichment analysis, variant calling and processing, and survival analysis
BMEG 320	48h for one TA in Term 2	**Bioengineering Feedback Systems and Controls** Modelling, analysis and simulation of dynamic systems; system modelling by state space; linearization; feedback, stability and sensitivity; control system design. Examples from biological systems, assistive systems and biomedical equipment.

BMEG 321	90h for each of five TAs in Term 2 80h for one STA in Term 2	**Biomedical Instrumentation** Fundamental principles of operation and types of medical equipment used for measurements of respiratory and circulatory systems, and biopotential signals, as well as open, minimally-invasive, and robotic surgery. Other topics include medical imaging, image processing, and simulations. Preferred skills/knowledge for this position: hands-on experience with biomedical sensors. MATLAB coding skills for signal and image processing is a must, and knowledge of medical instruments in clinical setting is appreciated.
BMEG 330	48h for each of two TAs in Term 2	**Biomechanics II** Principles and common elements of sports-, orthopaedic-, injury- and cellular length-biomechanics. Improving sports performance and preventing overuse injuries through sports biomechanics, designing orthopaedic implants through orthopaedic biomechanics, preventing injuries through injury biomechanics and identifying and filtering cancerous blood cells through cellular biomechanics.
BMEG 350	84h for one TA in Term 1 + Term 2 42h for each of two TAs in Term 2 42h for one TA in Term 1	**Human Structure/Function from Cells to Systems** Human anatomy, histology and physiology with examples from biomedical engineering. Anatomical compartmentation and function regulation; homeostatic control systems, sensors and effectors; intercellular communication strategies; and cellular and organ function assessment. Preferred skills/knowledge for this position: Knowledge of human physiology and anatomy. Familiarity with the biomedical engineering design process, including scoping problems and setting design requirements and criteria.

BMEG 357	72h for each of five TAs in Term 2 36h for one TA in Term 2	**Biomedical Engineering Design II** Creating innovations in biomedical technologies. Supervised design process for clinical clients, involving the building, testing, and verification of prototypes with potential users. Preferred skills/knowledge for this position: Experience with the biomedical engineering design process, including problem definition, setting design requirements and criteria, concept generation and evaluation, and verification/validation; experience with mentoring student groups and managing group dynamics is an asset; prototyping experience is an asset (including 3D printing); some roles include CAD experience, dimensioning and tolerancing; experience assessing student written work.
BMEG 371	72h for each of two TAs in Term 1	**Transport Phenomena within Cells and Tissues** Fluid flow and mass transport analysis within healthy and diseased cells and tissues using mathematics. Drug delivery and tissue engineering
BMEG 372	48h for each of two TAs in Term 1	**Biomedical Materials and Drug Delivery** Biomaterials science/engineering applied to design and synthesis of drug delivery systems. Biomaterial types, synthesis and testing; the use of biomaterials; biological response; biocompatibility and degradation; drug delivery systems; nanocarriers; modification of polymers; liposomes and micelles; nucleic acid, transdermal and oral delivery.
BMEG 373	48h for one TA in Term 1	**Microfluidics** Advantages and disadvantages of miniaturization of complex fluid flow processes. Manipulating liquid flow; electrophoretic velocity and mobility; serial dilution; capillary electrophoresis; integrated microfluidic platforms; and blood and the motility of bacteria.

BMEG 374 *	72h for each of five TAs in Term 2	**Cellular Bioengineering: Laboratory and Design** Fundamental genetic, molecular, and tissue engineering techniques. Design of experiments and tools related to these essential cellular bioengineering techniques. TA requirements: Experience with a variety of wet-lab skills that range from molecular cloning, PCR, and cell culture; experience teaching students in a lab environment; some roles include group project mentorship and experiment design. *See note below table for more details.*
BMEG 400J/591J	48h for one TA in Term 2	**Immuno-engineering** Immuno-engineering is the application of biomedical engineering principles to field of immunology. To explore these concepts, this course is structured around three main themes: – The immune system is involved in nearly every biomedical challenge; – Biomedical engineers must have some fluency in the 'language' of immunology; – The opportunities for engineering applications within the immune system are boundless and ever evolving.
BMEG 400K/591K	48h for one TA in Term 2 72h for one TA in Term 2	**Wearables** Interface of physiology and technology; wearable devices; transduction; physiological signal processing; machine learning; decision making; the influence of clinical needs on technology development; the limitations of technology for clinical applications; understanding the effect of unknown environments of data collection and health informatics. Preferred skills/knowledge for this position: familiarity with human participant data collection; experience with data analytics, preferably with machine learning and reinforcement learning; Matlab coding.

BMEG 400L/591L	96h for one TA in Term 2	**Experimental Microfluidics** This is an advanced practical course in microfluidic approaches for bioanalytical applications. The course will overview microfluidics from fabrication through microscale flow control, to analysis, design of experiments and characterization. In each topic, hands-on experience will be given with lab sessions demonstrating the key features. Selected applications in biomedicine, materials and chemistry will be studied. Preferred skills/knowledge for this position: experience in microfluidics, CAD design and Comsol.
BMEG 400Q/591Q	100h for one TA in Term 1	**Medical image processing with introduction to Machine Learning Models**
BMEG 400X/591X	96h for one STA in Term 1 152h for one TA in Term 2	**Sex Differences in Injury Biomechanics**
BMEG 402	80h for one TA in Term 1 40h for one TA in Term 1	**Impact of Biomedical Engineering on Society, Sustainability and Environmental Stewardship** Impact of biomedical engineering on health, safety, and political, cultural, economic, and environmental implications of biomedical engineering design

BMEG 410/510	100h for each of two TAs in Term 1	**Biomedical Equipment, Physiology, and Anatomy** Principles and operation of biomedical equipment for cardiovascular system, respiratory system, renal dialysis, endoscopy, surgery, and imaging. Functional relationships of biomedical equipment to physiology and anatomy of major body systems. Preferred skills/knowledge for this position: knowledge of human physiology and anatomy; engineering design background an asset.
BMEG 420	36h for one TA in Term 1	**Medical Imaging** Physical principles of ultrasound, magnetic resonance, computed tomography, X-ray projection imaging and molecular imaging in medical imaging for diagnostics, therapeutics, and interventions.
BMEG 421/521	48h for one TA in Term 1	**Linear System in Optics** "Linear systems" is a broad and important area in many scientific and engineering disciplines, and it is especially important in optics because it forms the basis for Fourier optics, diffraction theory, image-quality assessment, and many other areas. This course is an optical engineering course that is designed to introduce concepts in Linear system theory and Fourier Optics. The goal of the class is to provide understanding of the mathematics behind linear systems and Fourier transforms and be able to apply these skills to a wide variety of applications in optics including wave propagation and image quality assessment. This course covers basic concepts and techniques of linear systems, including Fourier series, continuous and discrete Fourier transforms, convolution, sampling and aliasing using the language, notation, and applications from optics, imaging, and diffraction all from the perspective of propagating electromagnetic fields.

BMEG 422/522	48h for one TA in Term 2	**Modern Biomedical Optical Imaging** Biomedical optical imaging techniques in general exhibit outstanding resolution and molecular specific contrast. Recently multimodal concepts help to combine complementary strengths of different optical imaging technologies. This course covers the advanced multimodal optical imaging concepts using optical coherence tomography (OCT) as a core technology. OCT is an emerging optical imaging technology for label-free, high-resolution, three-dimensional imaging technique, which has been recognized as the latest innovation milestone in the history of biomedical engineering. The first half of the course will focus on fundamental optics and optical OCT theories with an opportunity of getting hand-on experience in 3D image processing of biological imaging data. The second half will introduce advanced modern OCT technologies and broad range of OCT application in clinical medicine and biomedical engineering.
BMEG 423/523	78h for one TA in Term 1	**Clinical Informatics** Clinical informatics is the application of information engineering to health care, particularly the management and use of patient health and well-being information. This course introduces students to fundamental concepts in clinical information systems, decision support, and mobile health.
BMEG 424/524	132h for one TA in Term 2 125h for one TA in Term 2	**Genome Informatics** We will discuss the best practices when dealing with genomics data, common pitfalls, and statistical analyses. You will gain an appreciation for genome informatics by dissecting published examples, and a practical understanding through hands-on exercises. After taking this course, you will be able to design, analyze, and interpret genomics experiments with confidence.

BMEG 425	84h for one TA in Term 2	**Biomedical Robotics** This course serves as a primer on the emerging field of biomedical robotics. The first half of the course focuses on the mathematical fundamentals of kinematics, dynamics and control of robots by human operators. The second half of the course will introduce state-of-the-art applications of biomedical robotics and discuss the real-world challenges of directly interfacing a biological system with an artificially engineered system. The course project will challenge students to propose a design for a biomedical robot and evaluate each other's proposals.
BMEG 455	87h for one TA in Term 1 72h for each of two TAs in Term 1 36h for one TA in Term 1	**Professionalism and Ethics in Biomedical Engineering** Ethical, equity, and diversity issues and professionalism in Biomedical Engineering practice and design. Case studies and design projects will be used to expand on the foundation of biomedical engineering design, applying real-world ethical dilemmas including professional, medical, and research ethics. Preferred skills/knowledge for this position: skills in facilitation of, and marking of, discussions/debates; background as an engineering student with knowledge of the codes of ethics and standards of professionalism; great communication skills (both oral and written) and ability to assess that in others
BMEG 456/556	62.5h for one TA in Term 1	**Clinical and Industrial Biomedical Engineering** Principles of clinical practice, Canadian healthcare system, medical approach to diagnosis, ethics and regulations for clinical trials, medical technology management, medical device development and standards, biostatistics.

BMEG 457	72h for each of nine TAs over two terms (T1 & T2) 90h for one TA over two terms (T1 & T2) 108h for one TA over two terms (T1 & T2) 36h for one TA over two terms (T1 & T2)	**Biomedical Engineering Design Project** Capstone design and development of a practical biomedical device or system. Projects provided by local industry and engineering research laboratories. <u>Preferred skills/knowledge for this position:</u> Cellular and molecular: Experience with molecular biology and biochemistry techniques such as cloning and production/purification of plasmid DNA, cell culture (bacterial and mammalian), plate-based assays, flow cytometry and microscopy skills are desired but not required. Biomedical systems and signals: Experience working with different biosensors and electronics, and microcontrollers. Relevant programming skills. Knowledge in designing PCB is desired but not required. Biomaterials and biomechanics: Experience with solid or fluid mechanics, machine design, CAD and assembly drawings, 3D printing, CNC and machining-related knowledge is helpful. Synthetic manufacturing (e.g. microneedles, advanced 3D printing) are desired but not required. Biomedical informatics: Data analysis, programming skills, machine learning.
BMEG 470/591Y	48h for two TAs in Term 2	**Cellular Responses to Forces and Biomaterials** Mechanical forces and biomaterials regulating cellular functions critical to development, regeneration and repair.
BMEG 474	72h for one TA in Term 2	**Stem Cells and Regenerative Medicine** BMEG 474 will introduce students to the biology, state-of-art measurement, engineering technologies and applications of stem cells in regenerative medicine.

BMEG 490	54h for one TA over two terms (T1 & T2)	**Introduction to Academic Research** Research project directed by a faculty member in Biomedical Engineering. Course may include workshops. TA duties include: Assisting coordinator and supervising faculty to grade some course deliverables (i.e. reports, web abstracts, student progress reports); assisting and mentoring undergraduate students in learning scientific approaches and research writing; attending student presentations and providing feedback and grading input; helping coordinator schedule presentations along with the course Canvas; assisting the coordinator in matching students with faculty/projects
BMEG 500/501	130h for for one TA over Term 1 + Term 2 117h for one TA over Term 1 + Term 2	**BMEG 500 Orientation to Clinical Environment** Operation of biomedical and clinical engineering facilities at hospitals. Daily activities of healthcare workers. Patients experience. **BMEG 501 Interdisciplinary Team Project in Medical Technology Innovation** These are part of the Engineers in Scrubs program. Preferred Qualifications - Familiarity with the Stanford biodesign process and how it could be adapted for a graduate program in biomedical engineering (e.g., Engineers in Scrubs) - Ability to communicate clearly and tactfully with internal and external partners - Strong organizational, leadership, and mentorship skills and ability to self-moderate - Expertise with Canvas at TA level (ability to create teams, assignments, deadlines, etc.) - Must attend classes at VGH prior to 8AM to set up AV as needed - Must accompany students on clinical site tours (approximately 4, first winter term only)
BMEG 511	25h for one TA in Term 2 20h for one TA in Term 2	**Fundamentals of Applied Pathophysiology in Biomedical Engineering**

BMEG 550	55h for one TA in Term 2	**Biomedical Engineering Technology** This course covers the principles of operation, clinical applications, engineering design, construction, human machine interface, potential hazards and common problems of selected diagnostic and therapeutic medical devices in healthcare environment.
BMEG 557	17h for one TA in Term 1	**Statistical Methods for Evaluating Medical Technologies** This course covers the principles of operation, clinical applications, engineering design, construction, human machine interface, potential hazards and common problems of selected diagnostic and therapeutic medical devices in healthcare environment.
BMEG 580	36h for each of two TAs in Term 1	**Biomedical Engineering Topics at the Interface of Medicine and Engineering**
BMEG 581	48h for each of two TAs in Term 2	**Professional and Academic Development**
BMEG 591F	10h for each of two TAs in Term 2	**Topics in Biomedical Engineering - Mammalian Synthetic Biology**
BMEG 598	96h for one TA over two terms (T1 & T2)	**Biomedical Engineering Seminar**. BMEG 598 is a required course for all BMEG graduate students; therefore, to avoid a conflict of interest, the TA for this course must be a non-BMEG graduate student. Applicants from other departments are encouraged to apply.

* **BMEG 374:**

This course will enable students to develop a proficiency in fundamental genetic, molecular, and tissue engineering techniques that will prepare them to work in the field of cellular bioengineering. Students will also gain experience designing experiments and tools related to these essential cellular bioengineering techniques.

Desirable skills/experience for the BMEG 374 TA includes some or all of:

Culture and experience working with E coli
Animal cell culture:

- Lab safety, aseptic technique
- Passaging and seeding/plating cells
- Cell viability

Genetic engineering techniques:

- DNA/RNA isolation
- PCR, gel electrophoresis
- Molecular cloning including transformation/ transfection of cells
- Gene editing (i.e. CRISPR)

Additional asset to have:

- Sequencing

Protein engineering techniques:

- Isolation, quantification, separation
- Fluorescent tagging
- Proteomics

Additional asset to have:

- Western blotting
- Immunoprecipitation
- Proximity-dependent labeling

Find more information here: https://bme.ubc.ca/teaching-assistantships/