Toronto Metropolitan University

Department of Electrical, Computer, & Biomedical Engineering
Faculty of Engineering & Architectural Science

Course Outline (F2024)

BME229: Biomedical Physics

Instructor(s)	Jahan Tavakkoli [Coordinator] Office: KHE-332 Phone: See D2L Email: jtavakkoli@torontomu.ca Office Hours: Thursday 10-11 am, Friday 2-3 pm (in person)
Calendar Description	Application of physics in medicine. This survey course will address basic concepts of medical imaging, nuclear medicine and radiation isotopes, radiation therapy, gamma spectroscopy and trace element analysis, and biomedical laser applications.
Prerequisites	BME 100, CHY 102, CPS 188, ELE 202, MTH 240, PCS 125, PCS 211
Antirequisites	None
Corerequisites	None
Compulsory Text(s):	1. Introduction to Biomedical Physics- BME 229, Todd Pawlicki, Daniel J. Scanderbeg, George Starkschall, Krzysztof Iniewski, John G. Webster, Amit J. Nimunkar, 3rd Edition, 2022, Toronto Metropolitan University, Wiley Custom Learning Solutions, ISBN 9781394182015.
Reference Text(s):	1. Radiation Therapy Physics, by William R. Hendee, Geoffrey S. Ibbott, and Eric G. Hendee, John Wiley & Sons Inc., 3rd edition, 2005. 2. Medical Imaging, by Krzysztof Iniewski, John Wiley & Sons Inc., 2009. 3. Medical Instrumentation: Application and Design, by John G. Webster, John Wiley & Sons Inc., 4th edition, 2010. 4. Physics for Scientists and Engineers with Modern Physics, by Raymond A. Serway and John W. Jewett, Jr., 9th edition, 2013. 5. Physics in Biology and Medicine, by Paul Davidovits, Academic Press, 4th edition, 2012. 6. The Physics of Radiation Therapy, by Faiz M. Khan, Lippincott Williams & Wilkins 4th edition, 2009.
Learning Objectives (Indicators)	At the end of this course, the successful student will be able to: 1. Understands, interprets, articulates, and applies a basic knowledge of science in the identification, formulation and solution of basic problems. (**1a**) 2. Makes accurate use of technical literature and other information sources, and distinguishes between the information relevant to the problem situation and irrelevant information. (**3a**) 3. Demonstrates ability to conduct visual analysis. (**3b**) 4. Identifies appropriate technical literature and other information sources to meet a need, and clearly attributes sources. (**12a**) 5. Identifies resources and professional associations that address ongoing professional development. (**12b**)

	NOTE:*Numbers in parentheses refer to the graduate attributes required by the Canadian Engineering Accreditation Board (CEAB).*
Course Organization	3.0 hours of lecture per week for 13 weeks 0.0 hours of tutorial per week for 12 weeks
Teaching Assistants	Matthew Micsa, mmicsa@torontomu.ca
Course Evaluation	In-class iClicker Questions (1/3 for participation and 2/3 for correct answers) — 15 % In-class Paper Quizzes (5 quizzes) — 20 % In-class Medical Equipment VR Demo and iClicker Quizzes (4 demos/quizzes) — 15 % Final Exam — 50 % TOTAL: — 100 % **Note:** In order for a student to pass a course, a minimum overall course mark of 50% must be obtained. In addition, for courses that have both **"Theory and Laboratory"** components, the student must pass the Laboratory and Theory portions separately by achieving a minimum of 50% in the combined Laboratory components and 50% in the combined Theory components. Please refer to the **"Course Evaluation"** section above for details on the Theory and Laboratory components (if applicable).
Examinations	- iClicker pop-up questions will be administered during lectures. - 5 announced in-class paper quizzes (closed-book). A quiz date will be announced at least one week earlier. - 4 announced medical equipment virtual reality (VR) demos will be given during the lectures. Each demo will be followed by an iClicker quiz session. - Final exam: during exam period, two and a half hours, covers the entire course materials, closed-book, a student-made formula sheet is allowed (letter size, one sided, only formulas, no text).
Other Evaluation Information	- In-class paper quizzes and final exam will contain multiple-choice/short-answer/problem-solving questions. - In-class iClicker pop-up questions will contain multiple-choice questions. - All iClicker questions and paper quizzes are designed for individual student work. Sharing the answers and/or working on solutions in a group or getting help from other sources is considered as a breach of academic integrity and could trigger submitting a case of academic misconduct with the university's Academic Integrity Office. - Students must have their TMU photo ID available at all the times during lectures and during any quiz/exam, and ready to show it to the course instructor and/or invigilating TA upon request.

	- THERE WILL BE NO MAKEUP ARRANGEMENT FOR MISSING EITHER IN-CLASS ICLICKER QUESTIONS/QUIZZES OR IN-CLASS PAPER QUIZZES.
Teaching Methods	In person.
Other Information	- iClicker will be used for in-class clicker questions (http://www.iclicker.com/). Follow the instructions posted in D2L on how to purchase your iClicker Student app and to register it to the class. - Sharing of calculators, pencils, pens or erasers is not permitted during any course examination/quiz. - During any examination/quiz, only non-programmable calculator models allowed. Examples are: Sharp EL-546, Casio FX-991 or similar models. - Cell phones, laptops, tablets or any other mobile electronic devices must only be used for iClicker questions. Any other use of electronic devices during lectures and/or examination/quizzes is STRICTLY prohibited. - Cell phones must be on silence all the time during lectures. - TMU photo ID must be placed on the desk, at all times, during any course examination/quiz. - Talking to another student, glancing over another student's paper or being caught with non-allowed materials during an examination/quiz may result in a ZERO mark for the evaluation and a record of academic misconduct filed with the university's Academic Integrity Office.

Course Content

Week	Hours	Chapters / Section	Topic, description
1	1		Course Introduction
1	1		Biomedical Engineering as a Career
2-3	4		Basics of Nuclear Physics
3-4	4		Atomic Structure and Radioactive Decay
5-6	4		Radiation Interactions with Biological Matter - Radiobiology
7-8	4		Production of X-rays and X-ray Imaging

9-10	4		An Introduction to Radiation Therapy
11-12	5		Hyperthermia and Thermal Ablation for Cancer Treatment
12-13	4		Nuclear Medicine and Nuclear Imaging
3-13	3		In-class Paper Quizzes (5 Quizzes)
10-13	4		Medical Equipment VR Demos and iClicker Quizzes (4 Demos)

University Policies & Important Information

Students are reminded that they are required to adhere to all relevant university policies found in their online course shell in D2L and/or on the Senate website

Refer to the Departmental FAQ page for furhter information on common questions.

Important Resources Available at Toronto Metropolitan University

- The Library provides research workshops and individual assistance. If the University is open, there is a Research Help desk on the second floor of the library, or students can use the Library's virtual research help service to speak with a librarian.
- Student Life and Learning Support offers group-based and individual help with writing, math, study skills, and transition support, as well as resources and checklists to support students as online learners.
- You can submit an Academic Consideration Request when an extenuating circumstance has occurred that has significantly impacted your ability to fulfill an academic requirement. You may always visit the Senate website and select the blue radio button on the top right hand side entitled: **Academic Consideration Request (ACR)** to submit this request.

  For Extenuating Circumstances, Policy 167: Academic Consideration allows for a once per semester ACR request without supporting documentation if the absence is less than 3 days in duration and is not for a final exam/final assessment. Absences more than 3 days in duration and those that involve a final exam/final assessment, require documentation. Students must notify their instructor once a request for academic consideration is submitted. See Senate Policy 167: Academic Consideration.
- If taking a remote course, familiarize yourself with the tools you will need to use for remote learning. The Remote Learning Guide for students includes guides to completing quizzes or exams in D2L Brightspace, with or without Respondus LockDown Browser and Monitor, using D2L Brightspace, joining online meetings or lectures, and collaborating with the Google Suite.
- Information on Copyright for Faculty and students.

Accessibility

- Similar to an accessibility statement, use this section to describe your commitment to making this course accessible to students with disabilities. Improving the accessibility of your course helps minimize the need for accommodation.
- Outline any technologies used in this course and any known accessibility features or barriers (if applicable).
- Describe how a student should contact you if they discover an accessibility barrier with any course materials or technologies.

Academic Accommodation Support

Academic Accommodation Support (AAS) is the university's disability services office. AAS works directly with incoming and returning students looking for help with their academic accommodations. AAS works with any student who requires academic accommodation regardless of program or course load.

- Learn more about Academic Accommodation Support.
- Learn how to register with AAS.

Academic Accommodations (for students with disabilities) and Academic Consideration (for students faced with extenuating circumstances that can include short-term health issues) are governed by two different university policies. Learn more about Academic Accommodations versus Academic Consideration and how to access each.

Wellbeing Support

At Toronto Metropolitan University, we recognize that things can come up throughout the term that may interfere with a student's ability to succeed in their coursework. These circumstances are outside of one's control and can have a serious impact on physical and mental well-being. Seeking help can be a challenge, especially in those times of crisis.

If you are experiencing a mental health crisis, please call 911 and go to the nearest hospital emergency room. You can also access these outside resources at anytime:

- **Distress Line:**24/7 line for if you are in crisis, feeling suicidal or in need of emotional support (phone: 416-408-4357)
- **Good2Talk:**24/7-hour line for postsecondary students (phone: 1-866-925-5454)
- **Keep.meSAFE:** 24/7 access to confidential support through counsellors via My SSP app or 1-844-451-9700

If non-crisis support is needed, you can access these campus resources:

- **Centre for Student Development and Counselling:** 416-979-5195 or email csdc@torontomu.ca
- **Consent Comes First - Office of Sexual Violence Support and Education:** 416-919-5000 ext 3596 or email osvse@torontomu.ca
- **Medical Centre:** call (416) 979-5070 to book an appointment

We encourage all Toronto Metropolitan University community members to access available resources to ensure support is reachable. You can find more resources available through the Toronto Metropolitan University Mental Health and Wellbeing website.