Western University
Department of Mechanical & Materials Engineering

MME 4470B – Medical and Assistive Devices

COURSE OUTLINE – 2025-2026

CALENDAR DESCRIPTION: Introduction to the design, development and operation of medical and assistive devices that can improve the quality of human life. Topics include design of assistive, corrective, and diagnostic devices; human factors engineering; biocompatibility of materials; bioelectronics; biosensors; and lab-on-a-chip systems.

COURSE INFORMATION:

Instructor: George K. Knopf, PhD, P.Eng.

Email: gkknopf@uwo.ca

Lectures/tutorials/labs: See Draft My Schedule

CONSULTATION HOURS: By appointment (in-person **or** to be arranged using Zoom)

PREREQUISITES: Completion of the third year of either the Mechanical Engineering, Mechatronics Systems Engineering, **or** Integrated Engineering program.

ANTIREQUISITES: None

ACCREDITATION UNITS: Engineering Science = 60%, Engineering Design = 40%

TOPICS:

Medical and assistive devices have evolved rapidly in recent years due to a better understanding of human physiology, availability of bio-compatible materials, advances in integrated electro-mechanical systems, and the introduction of innovative nano/micro technologies. Students will develop the knowledge and skills necessary to adopt an interdisciplinary approach to the design and development of medical and assistive devices through lectures, assignments, in-class seminars and term projects. Specific topics include:

1. **Introduction to Medical and Assistive Devices –** History of medical technology; medical device design process; classes of medical devices; government regulations and standards; reliability and safety; mistake-proofing; product recall; medical device failures.
2. **Human Factors** - Human factors engineering; anthropometric data; physical nature of humans; bones and joints; impact of injury and disease; human nervous system.
3. **Components of Medical Devices –** Medical materials; biocompatibility considerations; orthopedic implants; fracture fixation devices; electrophysiology; bioelectronic signal processing; neural interfaces.
4. **Applications –** Global health; mobility assistive technology; prosthetic limbs; artificial joints; neural prosthesis; brain-computer interface; biosensors; point-of-care devices.

LEARNING OUTCOMES:

The Mechanical and Materials Engineering Program has been accredited by Canadian Engineering Accreditation Board (CEAB) of Engineers Canada. Accredited programs provide the academic requirements for licensure as a professional engineer in Canada. Western Engineering has defined indicators of the 12 Graduate Attributes (GAs) that the CEAB expects graduating engineering students to demonstrate. The connections between course learning outcomes and Western Engineering's GA Indicators are identified below.

Upon successful completion of this course, students will be able to:

1. Explain the impact of government regulations on the development of new medical technologies (IESE1, **PR2**)
2. Describe the role of human factors in medical and assistive device design (PA1, **PR2**)
3. Analyze and evaluate the function of simple medical and assistive devices (KB3, PA1)
4. Describe the scientific and/or engineering principles used by a specific medical or assistive device (KB3, PA1, CS2, LL2)
5. Design, construct, and evaluate an assistive technology that can improve "quality of life" (D1, D2, **ITW2**, CS3)

CONTACT HOURS:

2 lecture hours and 2 laboratory hours per week, half course. Note that the laboratory work includes 3 hands-on assignments (~12hrs/term) and a group design project (>12hrs/term).

TEXTBOOK:

Cheng, M. (2003) *Medical Device Regulations: Global Overview and Guiding Principles*, World Health Organization, ISBN 92 4 154618 2 (Book available on-line)

Grout, J.R. (2007) *Mistake Proofing the Design of Health Care Processes Changing Designs to Reduce Error*, Agency for Healthcare Research and Quality, AHRQ Publication No. 07-0020 (Book available on-line)

UNITS:

SI will be used; however, English units may be introduced through examples as required.

EVALUATION:

The course grade will be determined as follows:

Individual Assignments (Total = 3)		
Assignment #1	(*Due: Feb. 9, 2026*)	10%
Assignment #2	(*Due: March 2, 2026*)	10%
Assignment #3	(*Due: March 23, 2026*)	10%
In-class Seminar	(*Feb. 23 to April 6, 2026*)	20%
Term Project		
Design Review #1	(*Feb. 2, 2026*)	5%
Design Review #2	(*March 9, 2026*)	5%
Prototype & Demonstration	(*April 6, 2026*)	10%
Technical Report	(*Due: April 9, 2026*)	30%

COURSE POLICIES:

Students who require an extension for an assignment, the seminar or the technical report are asked to contact the instructor by email. A one-week extension will be provided without academic penalty. However, all in-class presentations associated with the term project will be held on the scheduled dates.

General Faculty / University Policies

The Faculty of Engineering and Western University have overarching policies that prescribe how undergraduate courses should run. The course-specific policies described above should be considered *in addition to* those overarching policies, or as course-specific interpretations of them. In the event of contradictions or confusion between course-specific policies above and general Faculty / University policies, please contact your course instructor for clarification.

Western Engineering's undergraduate polices can be found by navigating to:
https://www.eng.uwo.ca/undergraduate/academic-support-and-accommodations/policies.html

and then clicking the "*Engineering Undergraduate Policies framework*" link.