Western Engineering

DEPARTMENT OF CHEMICAL & BIOCHEMICAL ENGINEERING
CBE 4421a INTRODUCTION TO BIOMATERIALS ENGINEERING

Course Outline Fall 2026

1. COURSE INFORMATION	
ANTIREQUISITE(s):	None
PREREQUISITE(s):	ES 1021A/B and completion of 3rd year of Engineering in Chemical, Electrical, Civil, Mechanical and Materials. Contact the instructor if you have specific questions regarding prerequisites, or potential special permissions requests.
CEAB Academic Units:	Engineering Science 65%, Engineering Design 35%
2. COURSE INSTRUCTOR	Dr. Amin S. Rizkalla Email: arizkall@uwo.ca TEB 337 / DSB 0025 82212 / 86086

3. **COURSE DESCRIPTION** (50 words max)

An introduction of materials science and engineering topics. The four materials classes (metals, ceramics, polymers, composites) will be addressed with emphasis upon the material types and material properties pertinent to their use in implanted medical devices. The structure and properties of biologic tissues and biocompatibility. Specific implant applications will be addressed.

General Learning Objectives (CEAB Graduate Attributes)

Knowledge Base	X	Engineering Tools		Impact on Society	
Problem Analysis	X	Individual & Teamwork		Ethics and Equity	
Investigation		Communication		Economics and Project Mgmt.	
Design		Professionalism		Life-Long Learning	

Rating: I – The instructor will introduce the topic at the level required. It is not necessary for the student to have seen the material before. D – There may be a reminder or review, but the student is expected to have seen and been tested on the material before taking the course. A – It is expected that the student can apply the knowledge without prompting (e. g. no review).

Learning Outcomes	**(CAEB) Graduate Attribute**
Introduction to Biomaterials Engineering At the end of this section, students will be able to: a. Demonstrate competence in specialized engineering knowledge such as implant behavior in body environment and the physicochemical and mechanical concepts that govern implant reliability.	KB4

b. Demonstrate the ability to evaluate the physical, chemical, and mechanical properties of biomaterials and formulate a strategy to design a biomaterial for a specific biomedical application.	PA4

Objectives.

- Understand metallic, ceramic, and polymer materials used for surgical and dental implants; biomaterials processing and selection, implant design, physical and mechanical testing; corrosion and wear in the body.
- Understand the aspects of biocompatibility that determine how the body responds to implanted biomaterials and devices.
- Understand the physical and mechanical properties of tissue as related to microstructure.
- Understand some applications of biomaterials.

Note: The four above learning objectives align with and are selected for the assessment of the above graduate attributes.

4. COURSE MATERIALS	**Required textbook $102.22** Biomaterials: an introduction. Park, Joon, Lakes, R. S., Springer, NY. 2007. **Reference textbook** "Biomaterials Science, An Introduction to Materials in Medicine" Edited by William R. Wagner, Shelly E. Sakiyama-Elbert, Guigen Zhang, Michael J. Yaszemski, 4th Edition 2020, Academic Press is an imprint of Elsevier

EXTRA COURSE INFORMATION

TERM STRUCTURE

Week	Topics	Exercise
Sept 7	Introduction / Biocompatibility	
Sept 14	Structure of Biomaterials	X
Sept 21	Characterization of Biomaterials	X
	Tutorial: (Quiz I closed book)	
Sept 28	Degradation of Biomaterials	
Oct 5	Structure of hard and soft tissue	X
	Tutorial: (Quiz II closed book)	
Oct 12	Study break	
Oct 19	Metallic Implants.	
	Tutorial: (Quiz III closed book)	
Oct 26	Presentations (Biomaterials applications).	
	Midterm examination	

Nov 2	**Presentations (Biomaterials applications).**	
Nov 9	**Ceramic implants**	
Nov 16	**Composite implants**	**X**
Nov 23	**Polymer implants**	**X**
	Tutorial: (Quiz IV closed book)	
Nov 30	**Controlled release**	
	Tutorial: (Quiz V closed book)	
Dec 8	**Project report submission (Graduate students only)**	
Dec (TBD)	**Final examination cumulative, 3h, closed book.**	

BRIGHTSPACE RESOURCES

Course lectures will be posted on OWL Brightspace **No cost to students**

5. METHODS OF EVALUATION

Name	% Worth	Due Date	Learning Outcomes
Quizzes	15	Sept 21, Oct 5, Oct 19, Nov 23, Nov 30	As described above in a & b
Midterm exam	40	Oct 26	As described above in a & b
Final exam	45	To be determined	As described above in a & b

Quizzes will be 50 minutes duration each. Midterm examination will be 2.0 h duration. Final examination will be cumulative, and 3.0 h duration. All examinations are closed book. Passing mark is 50%. Absences from quizzes, midterm and final examinations, the student should refer to the Policy on Academic Consideration – Undergraduate Students in First Entry Programs.

6. ADDITIONAL STATEMENTS

Statement on Use of Electronic Devices

Only non-programmable pocket calculators will be permitted during quizzes, midterm and final examinations. Smart phones should be turned off.

Statement of Use of Generative Artificial Intelligence (AI)

- The use of generative Artificial intelligence (GenAI) tools won't be discouraged in the Faculty of Engineering. As we pride ourselves on building the future we can't hide from the use of GenAI tools to contribute to the understanding of the course materials. However, the use of GenAI tools in any assignment or contribution during the course will have to be disclosed, as a resource.
- GenAI tools use won't be permitted in any type of examination or other assessments where the faculty have prohibited their use. If use of GenAI tools is detected by the instructor in these instances, academic offences penalties might be imposed against the student.

Statement on Academic Offences

The statement: "Scholastic offences are taken seriously and students are directed to read the Scholastic Offences policy, specifically, the definition of what constitutes a Scholastic Offence.

Additionally,

A) "All required papers may be subject to submission for textual similarity review to the commercial plagiarism detection software under license to the University for the detection of plagiarism. All papers submitted for such checking will be included as source documents in the reference database for the purpose of detecting plagiarism of papers subsequently submitted to the system. Use of the service is subject to the licensing agreement, currently between Western University and Turnitin.com."

B) "Computer-marked multiple-choice tests and/or exams may be subject to submission for similarity review by software that will check for unusual coincidences in answer patterns that may indicate cheating.

Support Services

The website for the Office of the Registrar, and the same for affiliated university colleges when appropriate, and any appropriate Student Support Services (including the services provided by the USC) and Academic Support and Engagement, are provided for easy access.

Statement on Gender-Based and Sexual Violence

"Western is committed to reducing incidents of gender-based and sexual violence (GBSV) and providing compassionate support to anyone who is going through or has gone through these traumatic events. If you are experiencing or have experienced GBSV (either recently or in the past), you will find information about support services for survivors, including emergency contacts on the Wellness and Wellbeing website. To connect with a case manager or set up an appointment, please contact support@uwo.ca."

"Students who are in emotional/mental distress should refer to Mental Health@Western for a complete list of options about how to obtain help."