

## ES 1021B – Properties of Materials

### COURSE OUTLINE – 2021

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This is the first course in the field of structure-property relationships for engineers. However, for some engineering disciplines at Western, this is the only course on material properties. Therefore, the course material includes a combination of fundamental concepts in materials science and specific examples to illustrate the impact of material choice on component performance and design.

**CALENDAR DESCRIPTION:** An Introduction to the relationship between the microstructure and the engineering properties of metals, ceramics, polymers, semi-conductors and composites. This relationship will be applied to demonstrate effective methods used to select materials for the design of engineering components.

**COURSE INFORMATION:**

Instructor:	Dr. Hamid Abdolvand Room CMLP 1308 Email: <a href="mailto:hamid.abdolvand@uwo.ca">hamid.abdolvand@uwo.ca</a>
Lectures:	Hybrid online Asynchronous Lectures M, F, 8:30-9:30 am Synchronous Lectures W, 4.30-5.30 pm
Tutorials:	Thursdays, 5:30-7:30pm (Via Zoom)

**CONSULTATION HOURS:** Mondays 11am-12, by appointment using zoom within OWL. Please contact me first using the email address above.

**ACCREDITATION UNITS:** Science= 50%, Engineering Science = 50%

**TOPICS:**

- 1. Classification of Materials**
- 2. Materials and Design**
- 3. Elastic Response of Materials**
- 4. Plastic Response of Materials**
- 5. Fracture Toughness and Fatigue**
- 6. Materials at Elevated Temperature**
- 7. Electrical, Magnetic and Optical Properties**

**SPECIFIC OBJECTIVES:**

On the successful completion of this course, the student will be able to:

1. a) Classify materials as a metal, ceramic, polymer or composite based on a knowledge of the atomic bonding and structure. b) Further classify polymers as either thermosets, thermoplastics or elastomers based on a knowledge of their molecular structure c) Further classify ceramics as engineering (technical) ceramics, traditional ceramics or ceramic glasses based on a knowledge of their atomic structure.
2. Given one or more equations describing the performance of a simple component (e.g. a tie-rod, column or beam) determine the material properties that govern the performance of the components.
3. Predict the elastic response of a simple component given a knowledge of the geometry and mode of loading.
4. Use constitutive relationships to calculate the plastic response of metals based on their microstructure
5. Estimate the fracture strength of engineering materials subjected to monotonic and cyclic loads.
6. Predict the response of engineering materials subjected to a known stress at elevated temperature.
7. Identify engineering materials as electrical conductors, semi-conductors or insulators based on atomic structure.

**CONTACT HOURS:** 2 asynchronous lecture hours, 1 synchronous lecture hour, 2 tutorial hours, half course

**REFERENCES:** The science and Engineering of Materials, 7<sup>th</sup> edition, by D. R. Askeland, and W. J. Wright.

**EXAMINATIONS AND QUIZZES:** Quizzes and term tests will be conducted through OWL during the tutorials.

Two term tests are held synchronously through OWL during first hour of tutorials:

**February 11**

**March 18**

The tentative dates for quizzes are **28 Jan, 4 Feb, 4 Mar, and 11 Mar.**

**TUTORIAL** Two-hour tutorial sessions will be held every week to discuss the materials covered in the lectures and take quizzes as well as term tests.

**EVALUATION:** The performance of students in this course will be evaluated on the basis of marks attained on quizzes, two mid-terms, and a final exam.

<b>Basis of final grade</b>		
Quizzes	4 quizzes x 5%	20%
Midterm tests	2 x 25%	50%
Final Exam		30%

**COURSE POLICIES:** The following course specific policies will be enforced throughout the course: Students are responsible for regularly checking their email, course website (<https://owl.uwo.ca>).

**Use of recordings:**

The synchronous lectures for this course will be recorded. The data captured during these recordings may include your image, voice recordings, chat logs and personal identifiers (name displayed on the screen). The recordings will be used for educational purposes related to this course, including evaluations. The recordings may be disclosed to other individuals under special circumstances. Please contact the instructor if you have any concerns related to session recordings. Participants in this course are not permitted to record the sessions, except where recording is an approved accommodation, or the participant has the prior written permission of the instructor

**Tutorials and quizzes:**

There will be no make-up quiz for the ones missed, irrespective if they were missed with or without consideration.

Missing a quiz with academic consideration will automatically shift the weight of the missed quiz onto the next midterm, i.e., quizzes 1 and 2 will be reweighted onto midterm 1, and quizzes 3, 4 will be reweighted onto midterm 2.

Students who arrive 15 mins after the scheduled tutorial quiz, will get zero mark for that quiz, irrespective if the quiz was missed with or without consideration.

Failure to attend a tutorial will translate into a zero mark for the quiz taken in that tutorial.

**Midterm and Final exams:**

No make-up midterm options will be offered regardless of the circumstances for which the midterm was missed.

Missing midterm exams with academic consideration will automatically shift the weight of the missed midterm exam onto the final exam.

Students must pass the final examination to pass this course. If a mark of less than 50% is obtained on the final examination, the student cannot receive a final mark greater than 48%.

**Overall exam policies for quizzes, midterms and final**

Missing any of the exams without academic consideration will translate to zero mark for the missed ones.

Collaboration is not permitted in any of the exams.

After each exam, several students may be asked to attend an oral exam-type interview to confirm their knowledge and the answers provided in the exam. Failure to attend an oral exam will translate to zero mark for the missed exam.

If quizzes and midterms are missed frequently, you will be debarred, without a notice, from writing the final examination for failure to maintain satisfactory academic standing throughout the year.

No technical assistance will be offered during exams. Students will be required to make all necessary efforts to maintain access to OWL until their exams are completed. Therefore, it is essential to make sure that your devices work fine and that you have a good internet connection.

**ENGLISH:**

In accordance with Senate and Faculty Policy, students may be penalized up to 10% of the marks on all assignments, tests and examinations for the improper use of English. Additionally, poorly written work with the exception of final examinations may be returned without grading. If resubmission of the work is permitted, it may be graded with marks deducted for poor English and/or late submission.

**ATTENDANCE:**

Any student who, in the opinion of the instructor, is absent too frequently from class or laboratory periods in any course, will be reported to the Dean (after due warning has been given). On the recommendation of the Department concerned, and with the permission of the Dean, the student will be debarred from taking the regular examination in the course.

**CHEATING:**

University policy states that cheating, including plagiarism, is a scholastic offense. The commission of a scholastic offence is attended by academic penalties which might include expulsion from the program. If you are caught cheating, there will be no second warning. (see Scholastic Offence Policy in the Western Academic Calendar).

**SSD:**

*Please contact the course instructor if you require material in an alternate format or if any other arrangements can make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x 82147 for any specific question regarding an accommodation.*

**NOTE:**

The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (ie.<50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain laboratory, assignment or test marks from previous years. Previously completed assignments and laboratories cannot be resubmitted for grading by the student in subsequent years.