

ES 1021B - Properties of Materials

COURSE OUTLINE – 2016-2017

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.

**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: Prof. C.T. DeGroot, Ph.D., P.Eng.
Room SEB 3096
Email: cdegroo5@uwo.ca
Lectures: M, W, F 8:30-9:30am (AHB 1R40)
Tutorials: W 4:30-6:30pm

**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

**LEARNING
OUTCOMES:**

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 knowledge of the atomic bonding and structure.
b) Further classify polymers as either thermosets, thermoplastics or elastomers based on knowledge of their molecular structure
c) Further classify ceramics as engineering (technical) ceramics, traditional ceramics or ceramic glasses based on 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 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: 3 lecture hours, 2 tutorial hours, half course

- TEXT:** “Materials: Engineering, Science, Processing and Design” 3rd edition M. Ashby, H. Shercliff, and D. Cebon; Butterworth-Heinemann (Elsevier) ISBN: 978-0-08-099434-5
- MIDTERMS:** Midterm #1 February 8, 2017, 4:30-6:00pm
Midterm #2 March 15, 2017, 4:30-6:00pm
- The midterms are written during the tutorial period.
Non-programmable calculators are allowed.
- TUTORIAL:** Two-hour tutorial sessions will be held every week to discuss the material covered in the lectures. Students are advised, but not required, to attend tutorials.
- EVALUATION:** The performance of students in this course will be evaluated on the basis of marks attained on the two midterms and a final exam.
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| BASIS OF | Midterms | 50% (2 × 25%) |
| FINAL GRADE: | Final Examination | 50% |
- The final examination will be a Closed Book examination. The use of nonprogrammable calculators will be permitted. If a minimum of 50% is not obtained on the final examination, the student cannot receive a mark greater than 48%.
- 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.