

MSE 3301a - Materials Selection

COURSE OUTLINE – 2021-2022

CALENDAR DESCRIPTION: Fundamentals of shaping and strengthening materials used in mechatronics components. Material selection based on the composite properties of an application. Smart material fabrication and application to modern mechatronic devices.

COURSE INFORMATION:
 Instructor: Dr. Eric Johlin
 Email: ejohlin@uwo.ca
 Lectures: We. 08:30-10:30 SEB 3109
 Th. 08:30-09:30 SEB 2202
 Tutorials: *TA Office Hours*

PREREQUISITES: MSE 2202a/b
 Unless you have either the requisites for this course or written special permission from your Dean to enrol in it, you will be removed from this course and it will be deleted from your record. This decision may not be appealed. You will receive no adjustment to your fees in the event that you are dropped from a course for failing to have the necessary prerequisites.

ANTIREQUISITES: MME 3379a/b

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

GENERAL LEARNING OBJECTIVES (CEAB GRADUATE ATTRIBUTES):

Knowledge Base	D	Use of Engineering Tools	D	Impact on Society and the Environment	D
Problem Analysis	D	Individual and Team Work	D	Ethics and Equity	
Investigation	D	Communication Skills		Economics and Project Management	D
Design	D	Professionalism		Life-Long Learning	

Notation: x represents the content level code as defined by the CEAB. blank = not applicable; I = introduced (introductory); D = developed (intermediate) and A = applied (advanced).

TOPICS:

1. Review of the types of materials used in mechanical components.
2. Review of material properties and their measurements: static strength, toughness, stiffness, fatigue, creep, etc.
3. Failure mechanisms
4. Formal selection procedures based on mechanical properties
5. Multi-objective optimization, and tradeoffs
6. Integration of shape and material in selection
7. Material processing and influence on selection through economic models
8. Overview of hybrid materials and their influence on selection
9. Environmental and sustainability considerations with materials
10. Use and application of materials selection software ANSYS GRANTA EduPack

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

1. Understand clearly the different material properties useful for design (KB3)
2. Analyze correlations and tradeoffs between material properties (PA1, I3)
3. Specify exact methods to measure these properties (KB3)
4. Use standard reference sources to compare materials (PA1, ET1)

5. Develop formal selection strategies using property limits and material indices (PA2)
6. Integrate shape into material selection (KB3)
7. Utilize material indices to generate diverse list of candidate solutions, and select the most promising materials for further analysis (D2, D3)
8. Develop selection strategies for process selection using economic analysis (EPM1)
9. Integrate considerations of sustainability and environmental impact into the selection process (IESE2, IESE3)
10. Understand creation and use of hybrid materials (KB3, D2)
11. Combine material, process, and shape information into a single selection methodology (D3)
12. Use the ANSYS GRANTA EduPack software (ET2)
13. Solve selected case studies using a combination of formal selection procedures and an understanding of generic engineering properties of materials (D3)

CONTACT HOURS: 3 lecture hours, 2 tutorial hours, half course

TEXTBOOK: M.F. Ashby “Materials Selection in Mechanical Design” 5th Edition, Butterworth-Heinemann, ISBN: 9780081005996 (**Required**)

SOFTWARE: ANSYS GRANTA EduPack software may be required for completion of some assignments. Access to the software is available for download to your personal computer via the Engineering Software site (<https://webstore.eng.uwo.ca/> login required)

UNITS: S.I. units will be used exclusively.

EVALUATION: The final grade is computed as follows:

Quizzes	40%
Quiz #1: Sep 27	
Quiz #2: Oct 11	
Quiz #3: Oct 25	
Quiz #4: Nov 15	
Assignments	10%
Assignment #1: Sep 23	
Assignment #2: Oct 7	
Assignment #3: Oct 21	
Assignment #4: Nov 11	
Final examination	50%
Held during December final examination period	

COURSE POLICIES: The following course-specific policies will be enforced throughout the course:

General

- **Lectures may vary between in-person, and synchronous (live) or asynchronous (pre-recorded) online formats. Changes will be announced via OWL,**
- Dates and other evaluation details are tentative and may be changed by the instructor. Notification will be sent through OWL
- Quizzes and exams will cover material presented in the textbook, lecture, lecture notes, and assignments, *as well as application and extension of these topics to new situations*
- This course is twinned between MME 3379 and MSE 3301, and so policies applying to this course extend to that course as well (e.g. limits on collaboration, group work, etc.)

Quizzes

- **Quizzes are take-home and must be completed on OWL within a fixed availability period.** This period will likely be 12 hours, but this will be announced on OWL before the first quiz and updated if needed.
- Quizzes will be timed, and must be completed within the allotted time. This is expected to be 50 minutes, but this may change between quizzes (this will be announced on OWL)
- Quizzes are linear; you cannot go back to change your answer to previous questions
- Quizzes are taken individually, and are closed-book, closed-note, with no discussion allowed
- Quizzes are weighted equally
- If a Quiz 1-3 is missed with consideration, the grade will be reweighted from those quizzes that were completed. If Quiz 4 is missed with consideration, the weight will be moved to the final exam. No make-up quizzes will be offered
- If a quiz is missed without consideration, a mark of 0 will be assigned for that quiz
- *If there is any suspicion that quiz integrity may be compromised, quizzes may switch to in-person for remainder of term*

Assignments

- Assignments are due by 8:00 am local time at Western
- **Assignments must be submitted electronically via Gradescope**
- While you are encouraged to discuss the assignments with other students, it is expected that all students fully understand all submitted work from their group, and be able to reproduce any steps therein individually
- Assignments are graded pass/fail, with reasonable effort (up to the discretion of the TA or instructor) granted full credit
- Specific feedback on assignments will not be provided, however solutions will be posted and discussed in class
- Individual feedback may be provided during office hours (TA or Professor)

Final examination

- Final exam will be *open-book for the official (bound) textbook only, self-printed copies are not allowed*
- The textbook will **not** be **required** for any part of the exam, but is **allowed**
- **It is strongly suggested to procure a copy of the textbook early to avoid shortages before the exam**
- Non-programmable calculators may be used. Computers, smartphones, tablets, etc. are not allowed
- *If there is any suspicion that exam integrity may have been compromised, we reserve the right to conduct follow-up oral examinations*

COVID-19**CONTINGENCY:**

In the event of a COVID-19 resurgence during the course that necessitates the course delivery moving away from face-to-face interaction, all remaining course content will be delivered entirely online, either synchronously (*i.e.*, at the times indicated in the timetable) or asynchronously (*e.g.*, posted on OWL for students to view at their convenience). The grading scheme will not change. Any remaining assessments will also be conducted online at the discretion of the course instructor

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.

CONSULTATION HOURS:	Prof. Johlin – TBA Teaching Assistants – TBA
CLASSROOM DEMEANOR:	<p>The instructor is committed to providing a respectful learning environment for all students involved in this course. This is a collective responsibility of the instructor and students, and therefore students partaking in this course agree to abide by this criterion. This includes attending lectures on time, following all safety protocols, and acting in a professional manner. Specific policies regarding online demeanor will be provide at the beginning of the course via OWL.</p> <p>Students will be expected to wear triple layer masks at all times in the classroom as per University policy and public health directives. Students who are unable to wear a mask must seek formal accommodation through Western Accessible Education, and present medical documentation. Students are not permitted to eat or drink while in class to ensure masks stay in place. Students will be able to eat and drink outside of the classroom during scheduled breaks. Students unwilling to wear a mask as stipulated by Western policy and public health directives will be referred to the Dean, and such actions will be considered a violation of the student Code of Conduct.</p>
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:	<i>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.</i>
INTERNET AND ELECTRONIC MAIL:	Students are responsible for regularly checking their Western e mail and the course web site (https://owl.uwo.ca/portal/) and making themselves aware of any information that is posted about the course. If the student fails to act on information that has been posted on these sites and does so without a legitimate explanation (<i>i.e.</i> those covered under the illness/compassionate form), then there are NO grounds for an appeal.
NOTE:	The above topics and outline are subject to adjustments and changes as needed. Students who have failed an Engineering course (<i>i.e.</i> <50%) must repeat all components of the course. No special permissions will be granted enabling a student to retain tutorial, assignment or test marks from previous years. Previously completed assignments and tutorials cannot be resubmitted for grading by the student in subsequent years.
ACCOMODATION POLICY	Accommodation Policies Students with disabilities work with Accessible Education (formerly SSD) which provides recommendations for accommodation based on medical documentation or psychological and cognitive testing. The accommodation policy can be found here: Academic Accommodation for Students with Disabilities .
	Academic Consideration for Student Absence Students will have up to two (2) opportunities during the regular academic year to use an on-line portal to self-report an absence during the term, provided the following conditions are met: the absence is no more than 48 hours in duration, and the assessment for which consideration is being sought is worth 30% or less of the student’s final grade. Students are expected to contact their instructors within 24 hours of the end of the period of the self-reported absence, unless noted on the syllabus. Students are not able to use the self-reporting option in the following circumstances:

- for exams scheduled by the Office of the Registrar (e.g., December and April exams)
- absence of a duration greater than 48 hours,
- assessments worth more than 30% of the student's final grade,
- if a student has already used the self-reporting portal twice during the academic year

If the conditions for a Self-Reported Absence are *not* met, students will need to provide a Student Medical Certificate if the absence is medical, or provide appropriate documentation if there are compassionate grounds for the absence in question. Students are encouraged to contact their Faculty academic counselling office to obtain more information about the relevant documentation.

Students should also note that individual instructors are not permitted to receive documentation directly from a student, whether in support of an application for consideration on medical grounds, or for other reasons. **All documentation required for absences that are not covered by the Self-Reported Absence Policy must be submitted to the Academic Counselling office of a student's Home Faculty.**

For Western University policy on Consideration for Student Absence, see [Policy on Academic Consideration for Student Absences - Undergraduate Students in First Entry Programs](#) and for the Student Medical Certificate (SMC), see: http://www.uwo.ca/univsec/pdf/academic_policies/appeals/medicalform.pdf.

Religious Accommodation

Students should consult the University's list of recognized religious holidays, and should give reasonable notice in writing, prior to the holiday, to the Instructor and an Academic Counsellor if their course requirements will be affected by a religious observance. Additional information is given in the [Western Multicultural Calendar](#).