

## 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](mailto: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:

|   |            |
|---|------------|
| <b>Quizzes</b>                                | <b>40%</b> |
| Quiz #1:           Sep 27                     |            |
| Quiz #2:           Oct 11                     |            |
| Quiz #3:           Oct 25                     |            |
| Quiz #4:           Nov 15                     |            |
| <b>Assignments</b>                            | <b>10%</b> |
| Assignment #1:   Sep 23                       |            |
| Assignment #2:   Oct 7                        |            |
| Assignment #3:   Oct 21                       |            |
| Assignment #4:   Nov 11                       |            |
| <b>Final examination</b>                      | <b>50%</b> |
| 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:**

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.

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.

**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.*

**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.e.* 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.e.* <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](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](#).

**INSTRUCTIONS FOR STUDENTS UNABLE TO WRITE TESTS OR EXAMINATIONS OR SUBMIT ASSIGNMENTS AS SCHEDULED**

If, on medical or compassionate grounds, you are unable to write term tests or final examinations or complete course work by the due date, you should follow the instructions listed below. You should understand that academic relief will not be granted automatically on request. You must demonstrate to your department (or the Undergraduate Services Office) that there are compelling medical or compassionate grounds that can be documented before academic relief will be considered. Different regulations apply to term tests, final examinations and late assignments. Please read the instructions carefully.

**NEW: Requests for Academic Consideration using the Self-Reported Absence Form**

If you experience an unexpected illness or injury or an extenuating circumstance (48 hours or less) that is sufficiently severe to temporarily render you unable to meet academic requirements (e.g., attending lectures or labs, writing tests or midterm exams, completing and submitting assignments, participating in presentations) you should self-declare using the online Self-Reported Absence portal. This option should be used in situations where you expect to resume academic responsibilities within 48 hours or less.

Each student will be allowed a maximum of two self-reported absences between September and April and one self-reported absence between May and August. Self-reporting may not be used for final exams or assessments (e.g. midterm exams, tests, reports, presentations, or essays) worth more than 30% of any given course.

For full instructions about the Self-Reporting System refer to the Academic Calendar link [here](#).

**A. GENERAL REGULATIONS & PROCEDURES (other than self-reported absences)**

1. All first year students will report to the Undergraduate Services Office, SEB 2097, for all instances.
2. If you are an upper year student and you are missing a test/assignment/lab or examination that is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If your course work is worth MORE THAN 10% of your final grade, you will report to the Undergraduate Services Office, SEB 2097.
3. Check the course outline to see if the instructor has a policy for missed tests, examinations, late assignments or attendance.
4. Documentation must be provided as soon as possible. If no one is available in your department office or the Undergraduate Services Office, leave a message clearly stating your name & student number and reason for your call. The department telephone numbers are given at the end of these instructions.
5. If you decide to write a test or an examination you should be prepared to accept the mark you earn. Rewriting tests or examinations or having the value of a test or examination reweighted on a retroactive basis is not permitted.

**B. TERM/MIDTERM TESTS (other than self-reported absences)**

1. If you are in first year and you are unable to write a midterm/term test, contact the Undergraduate Services Office, SEB 2097 PRIOR to the scheduled date of the test.
2. If you are an upper year student and you are unable to write a midterm/term test, inform your instructor PRIOR to the scheduled date of the test. If the instructor is not available, leave a message for him/her at the department office. If the test is worth LESS THAN 10% of your mark, you should report to your department office to request relief. If the test is worth MORE THAN 10% of your final grade you will report to the Undergraduate Services Office, SEB 2097 to request relief.
3. Be prepared to provide supporting documentation to the Department Chair and/or the Undergraduate Services Office (see next page for information on documentation).
4. Discuss with the instructor if and when the test can be rescheduled. **N.B.** The approval of the Chair or the Undergraduate Services Office is required when rescheduling midterm/term tests.

**C. FINAL EXAMINATIONS (cannot be self-reported)**

1. If you are unable to write a final examination, contact the Undergraduate Services Office **PRIOR TO THE SCHEDULED EXAMINATION TIME** to request permission to write a Special Final Examination. If no one is available in the Undergraduate Services Office, leave a message clearly stating your name & student number.
2. Be prepared to provide the Undergraduate Services Office with supporting documentation (see next page for information on documentation) the next day, or as soon as possible (in cases where students are hospitalized). The following circumstances are not considered grounds for missing a final examination or requesting special examinations: common cold, headache, sleeping in, misreading timetable and travel arrangements.
3. In order to receive permission to write a Special Examination, you must obtain the approval of the Chair of the Department **and** the Associate Dean and in order to apply you must sign a "Recommendation for a Special Examination Form" available in the Undergraduate Services Office. The Undergraduate Services Office will then notify the course instructor(s) and reschedule the examination on your behalf.

**PLEASE NOTE: It is the student's responsibility to check the date, time and location of the Special Examination.**

**D. LATE ASSIGNMENTS**

1. Advise the instructor if you are having problems completing the assignment on time (**prior** to the due date of the assignment).
2. Be prepared to provide documentation if requested by the instructor (see reverse side for information on documentation).
3. If you are granted an extension, establish a due date. The approval of the Chair of your Department (or the Assistant Dean, First Year Studies, if you are in first year) is not required if assignments will be completed prior to the last day of classes.
4.
  - i) Extensions beyond the end of classes must have the consent of the instructor, the department Chair and the Associate Dean, Undergraduate Studies. Documentation is mandatory.
  - ii) A Recommendation of Incomplete Form must be filled out indicating the work to be completed and the date by which it is due. This form must be signed by the student, the instructor, the department Chair and the Associate Dean, Undergraduate Studies.

**E. SHORT ABSENCES**

If you miss a class due to a minor illness or other problem, check your course outlines for information regarding attendance requirements and make sure you are not missing a test, laboratory or assignment. Cover any readings and arrange to borrow notes from a classmate.

**F. EXTENDED ABSENCES**

If you are absent more than one week or if you get too far behind to catch up, you should consider reducing your workload by dropping one or more courses. (Note drop deadlines listed below). You are strongly encouraged to seek advice from your Academic Counsellor in the Undergraduate Services Office.

**G. DOCUMENTATION**

If you consulted an off-campus doctor or Student Health Services regarding your illness or personal problem, **you must provide the doctor with a Student Medical Certificate** to complete at the time of your visit and then bring it to the Department (or the Undergraduate Services Office). **This note must contain the following information: severity of illness, effect on academic studies and duration of absence. Regular doctor's notes will not be accepted; only the Student Medical Certificate will be accepted.**

**In Case of Serious Illness of a Family Member:** Provide a Student Medical Certificate to your family member's physician to complete and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**In Case of a Death:** Obtain a copy of the death certificate or the notice provided by the funeral director's office. You must include your relationship to the deceased and bring it to the Department (or the Undergraduate Services Office if you are in first year).

**For Other Extenuating Circumstances:** If you are not sure what documentation to provide, ask the Departmental Office (or the Undergraduate Services Office if you are in first year) for direction.

**Note:** Forged notes and certificates will be dealt with severely. To submit a forged document is a scholastic offence (see below).

## H. ACADEMIC CONCERNS

1. You need to know if your instructors have a policy on late penalties, missed tests, etc. This information may be included on the course outlines. If not, ask your instructor(s).
2. **You should also be aware of attendance requirements in some courses. You can be debarred from writing the final examination if your attendance is not satisfactory.**
3. If you are in academic difficulty, check out the minimum requirements for progression in the calendar. If in doubt, see your Academic Counsellor.

**Calendar References:** Check these regulations in your 2021 Western Academic Calendar available at [www.westerncalendar.uwo.ca](http://www.westerncalendar.uwo.ca).

[Self-Reporting Absences](#)  
[Absences Due to Illness](#)  
[Academic Accommodations for Students with Disabilities](#)  
[Academic Accommodations for Religious or Holy Days](#)  
[Course Withdrawals](#)  
[Examinations](#)  
[Scheduling of Term Assignments](#)  
[Scholastic Offences](#)  
[Student Medical Certificate](#)  
[Engineering Academic Regulations](#)

**Note:** These instructions apply to all students registered in the Faculty of Engineering regardless of whether the courses are offered by the Faculty of Engineering or other faculties in the University.

|                              |   |                    |
|------------------------------|---|--------------------|
| <b><u>Add Deadlines:</u></b> | First term half course (i.e. “A” or “F”)                            | September 16, 2021 |
|                              | Full courses and full-year half course (i.e. “E”, “Y” or no suffix) | September 16, 2021 |
|                              | Second term half course (i.e. “B” or “G”)                           | January 11, 2022   |

|                               |  |                   |
|-------------------------------|--|-------------------|
| <b><u>Drop Deadlines:</u></b> | First term half course (i.e. “A” or “F”)                             | November 12, 2021 |
|                               | Full courses and full-year half courses (i.e. “E”, “Y” or no suffix) | November 30, 2021 |
|                               | Second term half or second term full course (i.e. “B” or “G”)        | March 7, 2022     |

### **Contact Information:**

|  |                               |  |
|--|-------------------------------|--|
| Undergraduate Services Office                                    | SEB 2097 Phone: 519-661-2130  | E-mail: <a href="mailto:engugrad@uwo.ca">engugrad@uwo.ca</a>                 |
| Chemical & Green Process Engineering                             | TEB 477 Phone: 519-661-2131   | E-mail: <a href="mailto:cbeugrad@uwo.ca">cbeugrad@uwo.ca</a>                 |
| Civil Engineering:   | SEB 3005 Phone: 519-661-2139  | E-mail: <a href="mailto:civil@uwo.ca">civil@uwo.ca</a>                       |
| Computer, Electrical, Mechatronic Systems & Software Engineering | TEB 279 Phone: 519-661-3758   | E-mail: <a href="mailto:eceugrad@uwo.ca">eceugrad@uwo.ca</a>                 |
| Integrated Engineering   | ACEB 2410 Phone: 519-661-6725 | E-mail: <a href="mailto:engceli@uwo.ca">engceli@uwo.ca</a>                   |
| Mechanical Engineering   | SEB 3002 Phone: 519-661-4122  | E-mail: <a href="mailto:mmeundergraduate@uwo.ca">mmeundergraduate@uwo.ca</a> |

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