Instructor: Dr. J. McDermid
Office: JHE-343C/A
e-mail: mcdermid@mcmaster.ca
course e-mail: eng4t04@mcmaster.ca
Office hours: To be determined in consultation with the class or by appointment

Lectures: Tuesday and Thursday 12:30-14:20; T13 107. Lectures will be held for the first ten weeks of classes (approximately), after which students will be free to work on their final projects.

Tutorials: Wednesday (T01) 10:30-11:20; ETB 228 and Wednesday (T02) 09:30-10:20; T13 105.

Tutorials will start on Wednesday September 12th and will continue through the term. Tutorials constitute an important part of the course and provide students the opportunity for direct consultation with Dr. McDermid and the TAs on the term projects, assignments and final project. Switching of tutorial sections will not be permitted until after the submission of project #2 in order to facilitate team consultations on the final project. Students should bring their laptop computers to tutorials.

Learning Outcomes

By the end of this course, the student should be able to:
1. Derive materials indices associated with specified design objectives or constraints, be they mechanical, thermal, cost, environmentally driven or any combination thereof;
2. Employ their derived materials indices to select the optimum material(s) to meet their design requirements or constraints;
3. Employ their selected materials in designs of their own conception which fulfil the specified design objectives.

Graduate Attributes:

ENG 4T04 provides the undergraduate student the opportunity to develop competence in the following CEAB graduate attributes:

<table>
<thead>
<tr>
<th>Graduate Attributes</th>
<th>Learning Outcome Measurement Point</th>
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<tbody>
<tr>
<td>Knowledge Base for Engineering: (1.04 – Competence in Specialized Engineering Knowledge)</td>
<td>1 – 3</td>
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<tr>
<td>Problem Analysis: (2.01 – Demonstrates an ability to identify reasonable assumptions (including identification of uncertainties and imprecise information) that could or should</td>
<td>1, 3</td>
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be made before a solution path is proposed)

| Design: (4.01 – Recognizes and follows an engineering design process) | 1 – 3 |
| Design: (4.03 – Proposes solutions to open-ended problems) | 1 – 3 |
| Use of Engineering Tools: (5.02 – Demonstrates ability to use modern/state of the art tools) | 1, 2 |
| Communications Skills: (7.03 – Constructs effective oral or written arguments as appropriate to the circumstances) | 1 – 3 |

**Teaching Assistants:**

<table>
<thead>
<tr>
<th>Name</th>
<th>Office</th>
<th>Extension</th>
<th>E-mail</th>
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<tbody>
<tr>
<td>Yuanzhe (Jason) Chen</td>
<td>JHE 356</td>
<td>23317</td>
<td><a href="mailto:cheny235@mcmaster.ca">cheny235@mcmaster.ca</a></td>
</tr>
<tr>
<td>Sara Filice</td>
<td>JHE A203C</td>
<td>26585</td>
<td><a href="mailto:filicese@mcmaster.ca">filicese@mcmaster.ca</a></td>
</tr>
<tr>
<td>Vivek Patel</td>
<td>JHE A203C</td>
<td>26585</td>
<td><a href="mailto:patelvj@mcmaster.ca">patelvj@mcmaster.ca</a></td>
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**Teaching Assistant Office Hours:** TA office hours will be determined via a straw poll conducted in class to facilitate student access. TA office hours have historically been held in JHE A206 (subject to change). It is strongly suggested that you attempt to contact the TAs during scheduled office hours or during tutorials. Appointments outside of office hours should be arranged using the e-mail hyperlinks provided above.

**Course Website:** ENG 4T04/6T04 have a common Avenue to Learn (A2L) site which students can access via their MacID and password. The course A2L site is an important means of communication between Dr. McDermid and the class and should be consulted regularly. Course announcements, project and assignment information (including due dates), abridged lecture notes, assignment and project solutions and tutorial information will all be accessed through the ENG 4T04/6T04 A2L site. It is important to note that the website is not a substitute for regular attendance of lectures and tutorials. Students are reminded that they are solely responsible for keeping up-to-date with all course announcements, instructional materials and due dates, including postings on the course A2L site. Students should inform Dr. McDermid if they encounter problems with the course A2L site.

**Important Dates:** The following are draft due dates for major coursework components. Students should note that project due dates are subject to minor alterations depending on the delivery of lecture materials and other factors, except in the case of the final project report which is due on the final date of classes. It is the student’s responsibility to update themselves to any alterations in the due dates for coursework via in-class announcements or the course A2L site.

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mid-term examination</td>
<td>Thursday October 4, 2018</td>
</tr>
<tr>
<td>Project #1 – report due</td>
<td>Friday October 19, 2018</td>
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<tr>
<td>Project #2 – report due</td>
<td>Friday November 16, 2018</td>
</tr>
<tr>
<td>Final Project Proposal</td>
<td>Thursday November 1, 2018</td>
</tr>
<tr>
<td>Final Project – report due</td>
<td>Wednesday December 5, 2018</td>
</tr>
<tr>
<td>Final Project – peer evaluations due</td>
<td>Wednesday December 5, 2018</td>
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**Texts:** There is one course text and several supplementary texts (primarily from previous courses taken at McMaster) which will be helpful to consult in the solution of assignment problems and projects.

**Course text:** “Materials Selection in Mechanical Design, 5th Edition” by M.F. Ashby, Butterworth-Heinemann (2016). The textbook is available in the bookstore, with many used textbooks available. E-books are also available. The textbook is not required, but useful equations, examples and other resources are available in the text which students may find helpful for course assignments and projects.

**Supplemental:** “Mechanics of Materials, 5th Edition” by F.P Beer et. al.. This textbook should be consulted for a review of introductory solid mechanics. “Fundamentals of Heat and Mass Transfer, 6th Edition” by Incropera et al.. This textbook should be consulted for a review of fluid flow and steady-state and transient heat transfer.

**Software:** All students are required to download and install a copy of the 2018 Cambridge Engineering Selector software (CES Edupack 2018) in order to complete the problem sets and projects. A copy of the software can be downloaded from the ENG 4T04/6T04 A2L site. Software installation instructions are also posted on the A2L site. Unfortunately, an Apple iOS-compatible version of the CES software does not exist and students with Apple computers will have to run CES on a Windows partition.

**Course Topics:**

- Introduction to Materials Property Charts and Development of Materials Indices
- Materials Selection and Design based on Mechanical, Thermal and Mixed Design constraints
- Design of Hybrid Materials (with a strong emphasis on sandwich materials)
- Environmentally-based Materials Selection (i.e. Eco-Selection), including rudimentary life-cycle assessment

The above material will be delivered in the form of lecture modules, for which pdf versions of the PowerPoint slides will be posted on the course A2L site. The lecture materials will be supplemented by numerous in-class examples and case studies, the solutions for which will be delivered during the lectures and which will not be posted on the course A2L site. The vast majority of in-class exercises will employ the CES software. In-class examples are designed to help students with course assignments and projects and to prepare for the mid-term examination; it is strongly recommended that students attend the lectures to take advantage of these examples.

Tutorials will consist of several elements: (i) the basics of using the CES software, which will be conducted in the first tutorial sessions, (ii) consultation on assignment problems and general assistance with course material and (iii) project consultation. Dr. McDermid will attend the vast majority of the tutorials and students should avail themselves of this opportunity to consult with him.
Course Assessment and Details of Course Elements

The following mark distribution will be used for ENG 4T04/6T04:

Assignments: 10% (composite of all assignment marks)
Mid-Term: 15%
Project #1: 15%
Project #2: 20%
Final Project: 40%

See below for detailed information concerning details of each of the above elements and policies on late course work submission and use of the MSAF.

Unless otherwise noted, all coursework is due by 17:30 on the designated due date and should be submitted to the course drop box adjacent to JHE 359. In general, neat, legible, hand-written assignment solutions and project calculations are acceptable and encouraged. The body of project reports should be typewritten according the descriptions provided below.

Assignments

Problem sets are planned for roughly every second week of the term and will consist of questions concerning optimal materials selection and design of specific objects given defined design constraints. Assignments will be announced in class and posted on the course A2L site. The objective of the assignments is to prepare students for the class projects and the mid-term examination. Assignment due dates will be announced in class and on the course A2L site. Solutions to assignment problems will be discussed in the tutorials and will also be posted on the course A2L page approximately one week after the assignment due date. Students must submit individual, independently written solutions to the assignments in proper engineering format, consisting of the required and given, equations used in the solution of the problem and properly formatted drawings, plots and tables, as required. Assignment should be submitted with a title page which includes the student name, student number, course identification and assignment number. The pages of the submission must be properly fastened together. The TAs will not be responsible for the loss of assignment pages without adequate fastening. Students must submit all CES files used in the solution of assignment problems to the appropriate A2L assignment drop box. Files can be zipped or uploaded to A2L individually must be named per the following format to facilitate tracking: student last name, initial, (question number, for uploaded individual files only) and assignment number (e.g. doe_j_assign2.zip for J. Doe’s assignment 2 zipped CES files). Individual CES files named using this general format with an indication of the problem identification (e.g. or doe_j_P2_assign2.ces for J. Doe’s P2 CES file from assignment 2) are also acceptable.

Mid-Term Examination

There will be a two-hour mid-term examination which will assess the student’s ability to derive materials indices, select the optimal material(s) for given design constraints and develop a rudimentary design using their selected optimal material. The date for the mid-term is provided
in the “Important Dates” section and the final date will be confirmed during the lectures and posted on the A2L site. The CES software will not be used in the mid-term.

Projects #1 and #2

Two projects will be assigned during the term which will consist of a problem in mechanical design and materials selection with multiple constraints (project #1) and a more advanced problem in thermo-mechanical design and materials selection with multiple constraints (project #2). Design constraints for the projects can be mechanical, thermal/heat transfer, fluid flow, economic, environmental or any combination of the above. Individual reports will be submitted for projects #1 and #2. Project reports must conform to the guidelines specified in the document “Project Report Writing Guidelines” posted on the course A2L site. Student CES files must be submitted to the appropriate project A2L drop box, with the file name conforming to the format: student last name, initial and project number (e.g. doe_j_project2.zip for J. Doe’s project 2 CES files). Individual CES files named using this general format with an indication of the part identification are also acceptable.

Final Project – Proposal, Selection and Report

A final project consisting of a multi-faceted materials selection and design problem will be due at the end of the semester. Students registered in ENG 4T04 will form their own groups consisting of three or four members to work on a project that is of interest to the group. A group report will be submitted for the ENG 4T04 final project. Any student(s) who do not have a group will be assigned a group by Dr. McDermid. Groups of less than three students will not be permitted and groups of five students will only be permitted under special circumstances with a consummate increase in the difficulty of the project. Students enrolled in ENG 6T04 will develop an individual project and submit an individual project report. ENG 6T04 final project reports will present two solutions to the design problem and compare the two solutions based on functionality and economic evaluation criteria. All final project reports will be marked by Dr. McDermid.

All project proposals must be approved by Dr. McDermid. All student groups (ENG 4T04) and individual graduate students (ENG 6T04) will be required to fill out a project proposal form which can be downloaded from the course A2L site. Students are encouraged to select final projects which can have positive impact on or contribute to their capstone project (e.g. MATLS 4Z06 or MECHENG 4M06) or graduate studies project. Discussions with Dr. McDermid concerning the project proposal and its approval/modification will be completed as quickly as possible following submission of the project proposal. The final project report will comprise a properly formatted engineering report per the guidelines contained in the document “Project Report Writing Guidelines” on the course A2L site. Each group must submit the CES files used in their project to the final project A2L drop box with the filename conforming to the following format: group number (to be assigned by Dr McDermid) and “final project” (e.g. group 2 final project.zip for Group #2 final project CES files). Students enrolled in ENG 6T04 will follow the same protocols as students enrolled in ENG 4T04 with the exception that the proposals and reports will be submitted by a single student.
**Final Project – Peer Evaluation**

All ENG 4T04 student must submit an individual confidential peer evaluation form to the assigned A2L drop box, the Materials Science Departmental Office (JHE 357 – Chelsea Gregory) or directly to Dr. McDermid on the assigned final project due date. Peer evaluation forms are available from the course website. Anonymous or multiple peer evaluations will not be accepted, nor will peer evaluations submitted to the course drop box outside of JHE 359. Scanned and emailed peer evaluations from individual students will be accepted. The peer evaluation form will ask the following question: “You and your group members comprise a small engineering consulting company, where the fees charged by the company are split amongst the partners according to the relative effort a particular partner devotes to a project. A $100,000 fee is to be collected for the work performed on your ENG 4T04 project. How would you divide the fee amongst your partners?” The peer evaluations may be used to weigh the final project mark assigned to an individual group member; however, all mark weighting decisions will be at the discretion of Dr. McDermid. It should be noted that failure to submit an ENG 4T04 peer evaluation will result in a delay in the marking of the group project and assignment of final course marks.

**Final Examinations**

There is no final examination.

**Policy on Late Submission of Coursework**

All coursework must be submitted on time or deductions will be made without valid and documented reasons. All late coursework must be submitted directly to Dr. McDermid or to Chelsea Gregory in the MSE office (JHE 357). Late course work will not be accepted by the TAs. All late penalties will be assessed by Dr McDermid. The following penalties will apply:

- Assignments: a deduction of 25% per day to a minimum of zero credit. Assignments will not be accepted after the assignment solutions have been discussed in the tutorial and/or posted on Avenue to Learn (A2L).
- Projects: a deduction of 50% per day to a minimum of zero credit. Projects will not be accepted after the project solutions have been discussed in the tutorial and/or posted on A2L.

**Policy on the Use of the McMaster Student Absence Form (MSAF)**

In the event of an absence for medical or other reasons for which an MSAF form has been submitted, students should review and follow the Academic Regulation in the Undergraduate Calendar for “Requests for Relief for Missed Academic Term Work”.

Use of the MSAF will automatically result in the following accommodations:

- Assignments and Projects: accommodation for all assignments and projects will be a deferred due date, in this case 48 hours after the submission of the MSAF. The deferred assignment will be due to either Dr. McDermid or Chelsea Gregory in the MSE office by 17:30 of the revised due date. If the deferred due date falls on a Saturday, Sunday or statutory holiday, the coursework will be due to Dr. McDermid or Chelsea Gregory in the
MSE office at 09:00 on the next working day. Students should note that deferred assignments submitted to the course drop box outside of JHE 359 may not be collected and a mark of zero may be assigned. If the solutions for the assignment or project have been posted on the website or discussed in the tutorial, an alternative assignment or project will be assigned to the student.

- Mid-Term: a make-up mid-term will be held at an assigned time for all students who missed the examination.

Appeal of Marks:

All queries or appeals of marks received on course work, other than the final project, should first be directed at the TA who marked the work – it is his or her responsibility to clarify the deductions and remedy any errors. If, however, the student continues to feel that they received an unfair or erroneous deduction after discussing their case with the TA, students can submit their course work to Dr. McDermid for re-marking. Students should note that re-marking by Dr. McDermid may result in a lower mark being assigned than was originally received from the TA. All inquiries concerning final project marks should be directed solely to Dr. McDermid.

Important Notice to Students from the University Administration

“The instructor and University reserve the right to modify elements of the course during the term. The university may change the dates and deadlines for any or all courses in extreme circumstances. If either type of modification becomes necessary, reasonable notice and communication with the students will be given with explanation and the opportunity to comment on changes. It is the responsibility of the student to check their McMaster e-mail and course websites weekly during the term and to note any changes.”

Policy Reminder on Academic Integrity

“The Faculty of Engineering is concerned with ensuring an Environment that is free of all adverse discrimination. If there is a problem that cannot be resolved by discussion among the persons concerned, individuals are reminded that they should contact the Department Chair, the Sexual Harassment Officer or the Human Rights Consultant, as soon as possible.

Students are expected to exhibit honesty and use ethical behaviour in all aspects of the learning process. The academic credentials you earn are rooted in principles of honesty and academic integrity.

Academic dishonesty is to knowingly acting or fail to act in a way that results or could result in unearned academic credit or advantage. This behaviour can result in serious consequences, e.g. the grade of zero on an assignment, loss of credit with a notation on the transcript (notation reads: “Grade of F assigned for academic dishonesty”), and/or suspension or expulsion from the university.

It is your responsibility to understand what constitutes academic dishonesty. For information on the various types of academic dishonesty please refer to the Academic Integrity Policy, located at www.mcmaster.ca/academicintegrity.
The following illustrates only three forms of academic dishonesty:

1. Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
2. Improper collaboration in group work.
3. Copying or using unauthorized aids in tests and examinations.”

Policy Reminder on Academic Accommodation of Students with Disabilities

“Students who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. Academic accommodations must be arranged for each term of study. Student Accessibility Services can be contacted by phone 905-525-9140 ext. 28652 or e-mail sas@mcmaster.ca. For further information, consult McMaster University’s Policy for Academic Accommodation of Students with Disabilities.”

revised August 2018 by Dr. J. McDermid