

MATERIALS 1M03  
Structure and Properties of Materials

Course Outline 2018

Instructional Team



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JHE 213C



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All emails to our Avenue account will be forwarded to the above address. All emails to our personal email addresses will not be answered, please use the course email.

The Avenue message board will be used by the instructors to provide you with up-to-date information. This might include corrections, time changes and other updates. It's your responsibility to consult the message board on a regular basis.

Lectures

Section	Day	Time	Room	Instructor
C01	Tu We Fr	12:30 13:20	BSB/147	Dr. Phillion
C02	Tu We Fr	15:30 16:20	BSB/147	Dr. Phillion
C03	Mo We Th	17:30 18:20	BSB/147	Dr. Zurob

Each section of the class will cover exactly the same content. All course requirements (assignments, tests, exams, etc.) are common to the whole course. On a day-to-day basis however, the sections may not maintain exact synchronization. You should therefore attend the same lecture section continuously.

Daily Help Sessions / Office Hours

Need help on your assignment? Have a question about course content? Drop by the "Materials Orange Lounge" for daily help from TAs. JHE 352, Monday to Thursday, 1:30 to 3:30 (Starting Jan. 8th)

In addition, all of us would be happy to meet with you at any other time. Please email to arrange an appointment: [prof1m03@mcmaster.ca](mailto:prof1m03@mcmaster.ca)

Textbook

**Required text (see also required online content):** *Callister & Rethwisch, Materials Science and Engineering, An Introduction*. Any recent edition will suffice (8<sup>th</sup>, 9<sup>th</sup>, or 10<sup>th</sup>). The e-text can be purchased from the bookstore for ~\$64. The ISBN number is 978-1-118-54689-5.

## Method of Assessment

Seven assignments (On-line on Avenue)	20%
Two midterm tests	30%
Final exam	50%

## Tests and Exams

There will be two one-hour midterms. The subject area covered by each test will be discussed in class. The term tests will be held on the dates listed below. Please consult Avenue for the test locations.

<b>Term test #1:</b>	Monday February 12, 2017	7:00-8:00 pm
<b>Term test #2:</b>	Friday March 23, 2017	7:00-8:00 pm

You will need a calculator for both the term tests and the final exam. **The only acceptable calculators are the Casio FX 991 MS or Casio FX 991 MS Plus.** No other calculators are permitted. For both the term tests and the final exam you will be **provided with a formula sheet.** No other aids are allowed. You must bring your McMaster ID with you and display it on the writing table for inspection during tests and exams.

The final exam will cover all work studied throughout the semester. It will be three hours long. The date and time of the final exam will be scheduled by the [Registrar's Office](#).

## MSAFs

If you are unable to submit an assignment or quiz, or write a test due to illness, complete the on-line McMaster Student Absence Form (MSAF). More information can be found at the following link <https://www.mcmaster.ca/msaf/index.html>.

No follow up email is required. Grading will be as follows: MSAFs for midterms will automatically result in the weight being added to your final exam, MSAFs for Avenue assignments will result in the remaining assignments having additional weight so that the total assignment weight remains 20%. If you do not see your MSAF noted on your Avenue Grade Book two weeks after submission, please follow-up by email to [prof1m03@mcmaster.ca](mailto:prof1m03@mcmaster.ca).

## Assignments

There will be 7 assignments in this course. All of them will be done on the Avenue To Learn platform. The assignments and due dates will appear on Avenue and be posted below. Your assignment will be automatically submitted on the due date if you happen to not complete it. It is your responsibility for checking deadlines. No excuses will be accepted for not submitting your assignment on time. Questions will be a variety of true/false, multiple choice and numerical problems.

## Course Objectives

***MATLS 1M03 is an important part of your training as an engineer. It provides an essential Knowledge Base in Natural Sciences.***

**By the end of this course you should understand:**

- The main classes of materials and what distinguishes them
- The most important properties exhibited by materials
  - The range of properties exhibited by materials
  - The basis for materials selection based on properties
  - How materials selection integrates with engineering design

**In particular, you should know and understand:**

- (a) Types of bonding in solids and how they relate to key material properties such as melting point, thermal expansion and elastic constant.
- (b) Arrangement of atoms in solids.
- (c) The type of defects that exist within crystalline materials and their effect of material properties.
- (d) The relation between energy band structure and the electrical properties of materials.
- (e) Concept of steady-state and its application to simple diffusion and heat-transfer problems.
- (f) Strengthening mechanisms and fracture in solids.
- (g) Phase formation and change of state.

**As well as be able to:**

- (a) Read a binary phase diagram.
- (b) Distinguish between elastic and plastic deformation
- (c) Extract some material properties from experimental data.

**To get to this understanding you need these fundamentals:**

- The underlying *structure of solids* from the atomic to the macroscopic scale
- The nature of *defects and microstructure* in materials
- The *functional properties* of each class of materials
- The *mechanical properties* of each class of materials
- How properties depend on materials structure (*microstructure / macrostructure*)

## Ethics

You need to be familiar with the Statement on Academic Ethics and the Senate Resolutions on Academic Dishonesty. These documents are found in the Senate Policy Statements provided when you registered and are also available in the Senate Office. Any student who breaks these resolutions will be treated according to the published policy.

Academic dishonesty consists of misrepresentation by deception or by other fraudulent means and 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 kinds of academic dishonesty please refer to the Academic Integrity Policy, specifically Appendix 3. *Posting answers to assignment questions or detailed methods of solution is not acceptable on the Avenue message board, or on other social sites, e.g. Facebook.*

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.

## Academic Accommodation

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. 2865 or e-mail [sas@mcmaster.ca](mailto:sas@mcmaster.ca). For further information, consult McMaster University's Policy for [Academic Accommodation of Students with Disabilities](#).

## Discrimination Policy

McMaster University is concerned with ensuring an environment that is free of all adverse discrimination. If you encounter a problem that cannot be resolved through discussing it with the people involved, please contact the Department Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.

## Course Modules:

MODULE	TEXTBOOK CHAPTERS
M1: Materials Selection	No Textbook
M2: Mechanical Properties of Materials	6,8
M3: Atomic Bonding and Structure	2,3,4
M4: Transport of Heat, Mass, and Electrons	5, 18, 19
M5: Phase Diagrams	9
M6: Strengthening Mechanisms	7
M7: Materials for Silicon Valley	18, 20, 21(?)
Advanced Materials	Corrosion, Concrete, Biomaterials, Steels, Electronic Materials

## Follow Along Notes

Each Module contains a package of notes that the student can use to assist in following the class lectures

- The notes are to be filled-in during class, and contain definitions, practice problems, exam hints, and other 'catch-yah's'
- Many of the practice problems are performed in small working groups using a process of guided inquiry (active learning); After a set time, we have a group discussion

## Rough Lecture Schedule:

*At certain points in the course it may make good sense to modify the schedule outlined. The instructor reserves the right to modify elements of the course and will notify students accordingly (in class and post any changes to Avenue).*

<b>LECTURE SCHEDULE</b>				<b>DUE DATES</b>
	<b>Lecture #1</b>	<b>Lecture #2</b>	<b>Lecture #3</b>	
Week 1: Jan 1-5	N/A	N/A	Welcome Lecture	
Week 2: Jan 8-12	M1: Materials Selection	M1: Materials Selection	M1: Materials Selection	
Week 3: Jan 15-19	M2: Mech Properties of Materials	M2: Mech Properties of Materials	M2: Mech Properties of Materials	M1 Assig: Wed, Jan 17
Week 4: Jan 22-26	M2: Mech Properties of Materials	M2: Mech Properties of Materials	M2: Mech Properties of Materials	
Week 5: Jan 29-2	M3: Atomic Bonding and Structure	Advanced Materials: Corrosion (Kish)	M3: Atomic Bonding and Structure	M2 Assig: Wed, Jan31
Week 6: Feb 5-9	M3: Atomic Bonding and Structure	M3: Atomic Bonding and Structure	Review and Catch Up	M3 Assig: Sat, Feb 10
Midterm: Monday, February 12 2018				
Week 7: Feb 12-16	M4: Transport of Heat, Mass, and Electrons	M4: Transport of Heat, Mass, and Electrons	M4: Transport of Heat, Mass, and Electrons	
Week 8: Feb 19-23	Reading Week			
Week 9: Feb 26-2	Advanced Materials: Concrete (Bassim)	M5: Phase Diagrams.	M5: Phase Diagrams	M4 Assig: Wed, Feb 28
Week 10: Mar 5-9	M5: Phase Diagrams	M5: Phase Diagrams	Advanced Materials: Bio (Grandfield)	
Week 11: Mar 12-16	M6: Strengthening Mechanisms	M6: Strengthening Mechanisms	M6: Strengthening Mechanisms	M5 Assig: Wed, Mar14
Week 12: Mar 19-23	M6: Strengthening Mechanisms	Advanced Materials: Steels (Zurob)	Review & Catch Up	M6 Assig: Wed, Mar21
Midterm: Friday, March 23 2018				
Week 13: Mar 26-30	M7: Materials for Silicon Valley	M7: Materials for Silicon Valley	Good Friday (Thursday C03 class cancelled)	
Week 14: Apr 2-6	M7: Materials for Silicon Valley	Advanced Materials: Electronics (Kitai)	Review Lecture	M7 Assig: Mon, Apr 2
Week 15: Apr 9-13	Review	N/A	N/A	