MATLS 1M03
Course Outline

MATERIALS 1M03
Structure and Properties of Materials

Course Outline 2020

Instructional Team

Prof. Hatem Zurob
Course Coordinator
JHE 357/D

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ABB C305

Contact Email: prof1m03@mcmaster.ca
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

<table>
<thead>
<tr>
<th>Section</th>
<th>Day</th>
<th>Time</th>
<th>Room</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>C01</td>
<td>Tu We Fr</td>
<td>12:30 13:20</td>
<td>JHE 376</td>
<td>Dr. Zurob/Dr. Grandfield</td>
</tr>
<tr>
<td>C02</td>
<td>Tu We Fr</td>
<td>15:30 16:20</td>
<td>BSB 147</td>
<td>Dr. Zurob/Dr. Grandfield</td>
</tr>
<tr>
<td>C03</td>
<td>Mo We Th</td>
<td>10:30 11:20</td>
<td>TSH 120</td>
<td>Dr. Zurob/Dr. Grandfield</td>
</tr>
</tbody>
</table>

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, 5:30 to 7:20pm and Wednesday 11:30am to 1:30pm (Starting Jan. 13th).

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
Textbook
Required text: Callister & Rethwisch, Materials Science and Engineering, An Introduction. Any recent edition will suffice (8th, 9th, or 10th). A custom e-text including Chapters covered in this course can be purchased from the bookstore for ~$51.75. The ISBN number is 978-1-119-58098-0.

Method of Assessment

Four assignments (On-line on Avenue) 20%
Two midterm tests 30%
Final exam 50%
TOTAL 100%

Bonus Laboratories Available:
3 EPIC Labs 1% per lab
All 3 EPIC labs attended 4% total

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.

Term test #1: Monday February 3, 2019 7:00-8:00 pm
Term test #2: Monday March 9, 2019 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.

Assignments

There will be 4 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.

EPIC Labs

There will be 3 optional EPIC labs available for bonus participation marks. Please refer to Avenue postings for sign-up sheets. The labs will run Monday – Friday in ETB 126 from 2:30-5:30pm. Each lab is roughly 50min in length. You may sign up for any timeslot that fits your schedule, but if you do not attend, you will
not be permitted to sign up for another time. Please note that the EPIC labs for February 12th, will be held in JHE 352 because ETB 126 is not available on that day.

**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)

**Academic Integrity**

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

Academic dishonesty is to knowingly act 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:
- Plagiarism, e.g. the submission of work that is not one’s own or for which other credit has been obtained.
- Improper collaboration in group work.
- Copying or using unauthorized aids in tests and examinations.

**Academic Accommodation**

Students with disabilities who require academic accommodation must contact Student Accessibility Services (SAS) to make arrangements with a Program Coordinator. 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 Academic Accommodation of Students with Disabilities policy.

**Requests for MSAFs**

In the event of an absence for medical or other reasons, students should review and follow the Academic Regulation in the Undergraduate Calendar “Requests for Relief for Missed Academic Term Work”. More information can be found at the following link: [https://www.mcmaster.ca/msaf/index.html](https://www.mcmaster.ca/msaf/index.html).

For 1M03, 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.

**Academic Accommodation For Religious, Indigenous Or Spiritual Observances (RISO)**

Students requiring academic accommodation based on religious, indigenous or spiritual observances should follow the procedures set out in the RISO policy. Students requiring a RISO accommodation should submit their request to their Faculty Office normally within 10 working days of the beginning of term in which they anticipate a need for accommodation or to the Registrar's Office prior to their examinations. Students should also contact their instructors as soon as possible to make alternative arrangements for classes, assignments, and tests.

**Extreme Circumstances**

The University reserves the right to change the dates and deadlines for any or all courses in extreme circumstances (e.g., severe weather, labour disruptions, etc.). Changes will be communicated through regular McMaster communication channels, such as McMaster Daily News, A2L and/or McMaster email.

At certain points in the course it may make good sense to modify the course schedule. The instructor may modify elements of the course and will provide students with reasonable notice accordingly in class and via Avenue.
## Lecture Schedule

| Week 1: Jan 6-10 | Lecture #1: WELCOME LECTURE | Lecture #2: Structure: Bonding *Quick review of types. *Focus on U vs. r | Lecture #3: St: Crystallography *Crystalline vs amorphous *Concept of Unit cell. | DUE DATES: Week 1: |  
| Week 2: Jan 13-17 | St: Crystallography *SC, FCC, BCC, HCP | St: Crystallography *Miller Nomenclature *Bragg’s law | St: Crystal Defects *Point defects: vac, interst. *Diffusion |  
| Week 4: Jan 27-31 | St: Characterization *Guest lecture by KG *include images of defects | St: Non-Crystalline Materials | Review and Catch up | Assig1: (C2-4) Due: Jan 29  
| Week 5: Feb 3-7 | MIDTERM #1 MONDAY C01,C02: Take up Midterm C03: Q&A. | St: Phase Diagrams *Cu-Ni | St: Phase Diagrams *Eutectic. | MIDTERM #1 Mon Feb 3  
| Week 6: Feb 10-14 | St: Phase Transformations *similar to guest on steel | Properties: Mechanical *Intro *Elastic | Properties: Mechanical *Elastic *Poisson’s ratio | Assig2: (C5,9) Due: Feb 12  
| Feb 17-21 | Reading Week |  |  |  
| Week 12: Mar 30-Apr 3 | Materials for Silicon Valley Guest lecture by AK | Performance: Materials Selection | Performance: Materials Selection | Assig4: (C18,19) Due: April 1  
| Week 13: Apr 6-7 | Review | N/A | N/A | Practice Assig: Mat. Selection