Course: MTLS 2B03
Title: Introduction to the Thermodynamics of Materials

Instructor:
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Office Hours:
• Wednesday: 1:30 to 2:30 in JHE 352
• Friday: 1:30 to 2:30 in JHE 357D

Teaching Assistants:
– Yoel Emun
– Joshua Feather
– Daniella Pallisco

Calendar Description:

Two lectures, Two Tutorials, one lab (three hours, EOW); first term

Prerequisite(s): CHEM 1A03 or 1E03.

Course Topics:
Week 1: Significance of thermodynamics.
Week 2: First law of thermodynamics.
Week 3: Second law of thermodynamics.
Week 4: Auxiliary Functions.
Week 5: Heat Capacity, Enthalpy & Entropy.
Week 7: Third law of thermodynamics.
Week 8: Equilibrium in one component systems.
Week 9: Behavior of gases.
Week 10: Non-ideal gases.
Week 11: Electrochemistry.
Week 12: Formation cells, concentration cells.
Week 13: Review.

Course Objectives:
At the conclusion of this course, the student should be able to:
a) Understanding differences between isothermal and adiabatic processes leading to an ability to calculate their thermodynamic characteristics using the “function of state” concept.
b) Describe the first law of thermodynamics qualitatively and quantitatively.
c) Understand the concepts of enthalpy and entropy.
d) Describe the second law of thermodynamics and relate it to reversible and irreversible processes.
e) Be able to analyze and construct $P-T$ diagrams of unary systems and use information they contain for solving engineering problems.
f) Ability to describe gases in terms of the ideal gas law and van der Waals equation.
g) Ability to split an electrochemical reaction to anodic and cathodic processes and calculate its thermodynamic characteristics.
h) To gain a basic knowledge of how batteries work and being able to calculate their voltages.

Professional Development:

MATLS 2B03 is an important part of your training as an engineer. In particular:

Items (a-g) will contribute to your specialized engineering knowledge (CEAB attribute 1.4). Many courses will build on the knowledge gained in this course, including MATLS 2D03, 3B03, 3C03, 3T04, 4C03 and 4D03.

Primary Textbook:


Other useful Resources:

- Peter Atkins, Four Laws that Drive the Universe
- David Ragone, Thermodynamics of Materials
- Robert DeHoff, Thermodynamics in Materials Science

Lectures:

Tuesday and Thursday at 10:30, T13 125.

Tutorials:

Thursday and Friday, 9:30, T13 127.

Laboratories:

Laboratories are scheduled every other week. Each student will perform six experiments. The experiments are listed below and described in detail in the laboratory manual:
(1) Engines.
(2) Heat-Capacity.
(3) Pressure-Temperature Phase Diagram
(4) Formation and Concentration Cells.
Evaluation:

Lab Participation: 12% (4 labs in total)
Assignments: 12% (4 assignments in total)
Quizzes: 26% (2 quizzes, 1 hour each, Oct. 6th, Nov. 10th)
Final Exam 50% (2.5 hr exam).

* You will receive 3% for attending each of the labs, performing the required tasks and participating in the lab discussion with the TA. All students are expected to keep a hardbound lab book in which all lab observations and discussions are recorded. The TA will initial these at the end of each lab.
* Assignments are to be submitted into the appropriate drop-off box on Avenue. Late submissions will be penalized 25% per day.
* Stuff happens: You can submit one assignment up to 3 days late, without penalty.

Policy Reminders:

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 involved, individual are reminded that they should contact the Department Chair, the Sexual Harassment Office or the Human Rights Consultant, as soon as possible.
The Senate Resolution on Course Outlines states that:

“students should be reminded that they should read and comply with the "Statement on Academic Ethics and the Senate Resolution on Academic Dishonesty" as found in the Senate Policy Statements distributed at registration and available in the Senate Office”.

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, located at: http://www.mcmaster.ca/senate/academic/ac_integrity.htm

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.

Accessibility:

McMaster University is committed to fostering, creating and maintaining a barrier-free environment for all individuals providing equal rights and opportunities, including:
• Promoting a respectful attitude for persons with disabilities;
• Promoting awareness of the needs and abilities of persons with disabilities;
• Informing the University community about the services available to persons with disabilities and seeking to ensure that such services are delivered in ways that promote equity; and
• Providing support services, subject to certain limitations.

Students requiring service or accommodation contact Student Accessibility Services (SAS): http://sas.mcmaster.ca/ as soon as possible.
For more information, please visit http://mcmaster.ca/policy/Students-AcademicStudies/

Disclaimer:
"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 email and course websites weekly during the term and to note any changes."

Completed by: Hatem S. Zurob, August 2017