

MAT E 640 Advanced Materials Thermodynamics

Department of Chemical and Materials Engineering
University of Alberta

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Tuesday and Thursday, 1230-1350
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Recommended Textbook

1. David R. Gaskell, *Introduction to the Thermodynamics of Materials*, 5th edition, Taylor and Francis, 2008 (cost is \$ 155.95 new and \$ 85.23 used).
2. Course Website:
<http://www.ualberta.ca/~hao7/teaching.htm>

Supplementary Textbooks

1. S.A. Porter and K.E. Easterling, *Phase Transformations in Metals and Alloys*, 2nd edition, Chapman and Hall, 1992.
2. P. Haasen, *Physical Metallurgy*, 3rd edition, Cambridge, 1996
3. D.V. Ragone, *Thermodynamics of Materials, Volume I*, Wiley, 1995.
4. R.T. Dehoff, *Thermodynamics in Materials Science*, 1st and 2nd editions, McGraw-Hill, 1993 and 2006.
5. J.J. Moore, *Chemical Metallurgy*, 2nd edition, Butterworths, 1990.
6. *Handbook of Chemistry and Physics*, CRC Press - online version at <http://www.library.ualberta.ca/databases/databaseinfo/index.cfm?ID=3193>

Course Grading

Assignments	20%
Mid Term Exam (Thursday, October 22 nd 5:00-6:50pm, location NRE 1-001)	30%
Final Exam (Friday, December 11 th , 2:00-5:00pm, location TBA)	50%

- Assignments are to be submitted in the assignment box by 4:00 PM on the specified due date (usually on Thursday). Late assignments will not be accepted.
- Exams are closed-book; however a sheet with appropriate data and formulae will be provided. Approved non-programmable calculators only are permitted.
(www.engineering.ualberta.ca/calculator.cfm)
- No cell phones or MP3 players are allowed during exams.
- Policy about course outlines can be found in Section 23.4(2) of the University Calendar.
- The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the Code of Student Behaviour (online at www.ualberta.ca/secretariat/appeals.htm) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

- The conversion of marks from assignments and examinations into a final grade based on the four-point system will be performed by using absolute measures in combination with the subjective procedures described in Section 23.4(5) of the University Calendar.
- Students who require accommodations in this course due to a disability affecting mobility, vision, hearing, learning, or mental or physical health are advised to discuss their needs with Specialized Support and Disability Services, 2-800 SUB, 492-3381 (phone) or 492-7269 (TTY).

Course Outline

The aim of this course is to build on thermodynamic principles developed in your undergraduate program. Emphasis will be placed on solutions, phase equilibria in single- and multi-component systems, phase diagrams and reaction equilibria.

- Review (Chapters 1,2,3,5,6)
1st law, 2nd law and 3rd law – internal energy, enthalpy, entropy, heat capacity, free energy, auxiliary functions
- Statistical entropy (Chapter 4)
- Phase equilibrium in single component systems (Chapter 7)
- Nucleation and crystal growth
- Gases (Chapter 8)
- Solutions (Chapter 9)
- Phase diagrams (Chapters 10)
- Reactions with solutions (Chapter 13)