Course Outline

UNIVERSITY OF CALGARY
DEPARTMENT OF PHYSICS and ASTRONOMY
COURSE OUTLINE

1. Course: **Physics 449, Statistical Mechanics**

   Lecture/Time/Session(s): L01; TR, 15:30-16:45, ES 920, Fall 2011

   Instructor(s): Dr. D.L. Feder **Office:** SB 535, 220-3638
   Office Hours: T, 10:00-12:00
   Email: dfeder@ucalgary.ca
   Physics and Astronomy Office: SB 605, 220-5385

   Course website: http://people.ucalgary.ca/~dfeder/449

2. Prerequisite(s): Physics 325: Applied Mathematics 219 or Mathematics 253 or 263.

3. **GRADING**: The University policy on grading and related matters is described sections F.1 and F.2 of the online University Calendar. In determining the overall grade in the course the following weights will be used:

Weekly Previews	10%
Assignments	40%
Midterm Examination	25%
Final Examination	25%

A table of conversion from final course percentage to final course letter grade can be found on the Phys 449 site.

There will be a final examination scheduled by the Registrar's Office. A passing grade on the final examination is required in order to pass the course.

4. **Missed Components of Term Work**. The regulations of the Faculty of Science pertaining to this matter are found in the Faculty of Science area of the Calendar in section 3.6: **http://www.ucalgary.ca/pubs/calendar/current/sc-3-6.html**. It is the student's responsibility to familiarize himself/herself with these regulations. See also **http://www.ucalgary.ca/pubs/calendar/current/e-3.html**.

5. **TEXTBOOK:** There is no official textbook for this course, but we will be loosely following "*An Introduction to Thermal Physics*," by Daniel Schroeder (Addison-Wesley, 2000). Other suggestions for textbooks can be found on the course website.

6. EXAMINATION POLICY: Students are encouraged to read the Calendar, Section G, on Examinations: **http://www.ucalgary.ca/pubs/calendar/current/g.html**

Department Approval_____ **Date**_____

Associate Dean's Approval for
out of regular class-time activity: _____ **Date:**_____

7. OTHER IMPORTANT INFORMATION FOR STUDENTS:

(a) ACADEMIC MISCONDUCT (cheating, plagiarism, or any other form) is a very serious offence that will be dealt with rigorously in all cases. A single offence may lead to disciplinary probation or suspension or expulsion. The Faculty of Science follows a zero tolerance policy regarding dishonesty. Please read the sections of the University Calendar under K. Student Misconduct (**http://www.ucalgary.ca/pubs/calendar/current/k.html**) to inform yourself of definitions, processes and penalties

(b) ASSEMBLY POINTS in case of emergency during class time. Be sure to FAMILIARIZE YOURSELF with the information at http://www.ucalgary.ca/emergencyplan/assemblypoints.

(c) ACADEMIC ACCOMMODATION POLICY. Students with documentable disabilities are referred to the following links:
Calendar entry on students with disabilities: **http://www.ucalgary.ca/pubs/calendar/current/b-1.html**
Disability Resource Centre: **http://www.ucalgary.ca/drc/**

(d) SAFEWALK: Campus Security will escort individuals day or night (**http://www.ucalgary.ca/security/safewalk/**). Call **220-5333** for assistance. Use any campus phone, emergency phone or the yellow phones located at most parking lot pay booths.

(e) FREEDOM OF INFORMATION AND PRIVACY: This course will be conducted in accordance with the Freedom of Information and Protection of Privacy Act (FOIPP). As one consequence**, students should identify themselves on all written work by placing their name on the front page and their ID number on each subsequent page**. For more information see also **http://www.ucalgary.ca/secretariat/privacy.**

(f) STUDENT UNION INFORMATION: VP Academic **Phone**: 220-3911 **Email**: suvpaca@ucagary.ca.
SU Faculty Rep. **Phone:** 220-3913 **Email:** sciencerep@su.ucalgary.ca Website **http://www.su.ucalgary.ca/home/contact.html**.
Student Ombudsman: **http://www.su.ucalgary.ca/services/student-services/student-rights.html**

(i) INTERNET and ELECTRONIC COMMUNICATION DEVICE Information. You can assume that in all classes that you attend, **your cell phone should be turned off**. Also, communication with other individuals, via laptop computers, Blackberries or other devices connectable to the Internet is not allowed in class time unless specifically permitted by the instructor. If you violate this policy you may be asked to leave the classroom. Repeated abuse may result in a charge of misconduct.

Here's the breakdown of the material. This table of contents is pulled directly from the course notes.

4. Engines and Refrigerators
   (a) Heat Engines
   (b) Refrigerators
   (c) Real Heat Engines
      i. Stirling Engine
      ii. Steam Engine
      iii. Internal Combustion Engine
   (d) Real Refrigerators
      i. Home Fridges
      ii. Liquefaction of Gases and Going to Absolute Zero

5. Free Energy and Chemical Thermodynamics
   (a) Free Energy as Work
      i. Independent variables S and V
      ii. Independent variables S and P
      iii. Independent variables T and V
         - Independent variables T and P
         - Connection to Work
      vi. Varying particle number
   (b) Free Energy as Force toward Equilibrium

6. Boltzmann Statistics (aka The Canonical Ensemble)
   (a) The Boltzmann Factor
   (b) Z and the Calculation of Anything
      i. Example: Pauli Paramagnet Again!
      ii. Example: Particlein aBox(1D)
      iii. Example: Particlein aBox(3D)
         - Example: HarmonicOscillator(1D)
         - Example: HarmonicOscillator(3D)
      vi. Example: The rotor
   (c) TheEquipartitionTheorem(reprise)
      i. Density of States
   (d) The Maxwell Speed Distribution
      i. Interlude on Averages
      ii. Molecular Beams
   (e) Gibbs' Paradox

7. Grand Canonical Ensemble
   (a) Chemical Potential Again
   (b) Grand Partition Function
   (c) Grand Potential

Final Examination