PEP 330A Introduction to Thermal and Statistical Physics

Department of Physics and Engineering Physics
Stevens Institute of Technology
Semester: Spring 2018

Schedule:

Tuesday 4:00-4:50pm, BC203
Thursday 11:00-12:40pm, BC203

Instructor: Prof. Christopher Search

Email: csearch@stevens.edu
Office: Burchard 609
Office Hours: Tuesdays 3:00-4:00pm; Thursdays 4:00-5:00pm

Required Textbook

An Introduction to Thermodynamics and Statistical Mechanics 2nd Ed. by Keith Stowe (Cambridge University Press)

Course Objectives

The purpose of this course is to provide a basic introduction to the laws of thermodynamics and the applications of these laws to physical systems including engines and refrigerators. The course also will introduce the statistical foundations of thermodynamics including the definition of entropy. A statistical description of systems of particles will be developed and applied to the kinetics of classical particles. Bose-Einstein and Fermi-Dirac statistics will be introduced for the description of systems of quantum particles.

Course Prerequisites

The prerequisites for the course are PEP112 and MA124. Either PEP242 or PEP201 is a co-requisite.

Grading Procedure

Grades are calculated from a weighted average of homework and exams. The various components of your grade have the following weights:

Final Exam……..25%
Midterm Exam……..…..25%
Homework (11 of them)……..45%
Class Participation……5%

Homework will be assigned approximately weekly and will consist of approximately 4-6 problems from the textbook. Each HW problem will be graded on a scale of 0-10 (0=no attempt made; 10=100% correct). I will drop the lowest HW score and only use the best 10 of 11 for the final grade.

Final letter grades will be calculated based on the following distribution:

Letter Grade:	% Grade:
A	90-100%
A-	85-89.9%
B+/B/B-	70-84.9%
C+/C/C-	50-69.9%
D+/D/D-	30-49.9%
F	<30%

Lecture Schedule

Week Number	Chapter/Topic
1	Chapter 2: intro. to probability theory and statistics; Chapter 3: statistics of large systems
2	Chapter 3: Gaussian distribution; random walk
3	Chapter 1: review of quantum theory, density of states; Chapter 4: internal energy
4	Chapter 4: degrees of freedom, equipartition; Chapter 5: 1st law of thermodynamics, exchange of energy by heat, work, and particle diffusion
5	Chapter 6: internal energy and accessible states Chapter 7: interacting systems, 2nd law of thermodynamics, entropy
6	Chapter 8: temperature, heat capacity and 3rd law of thermodynamics;
7	Chapter 9: 2nd law constraints, fluctuations, 1st law constraints, thermodynamic potentials, Maxwell's relations.
8	Chapter 13: engines, refrigerators, Carnot cycle
9	Chapter 15: probability system is in particular state, classical vs. quantum statistics, simple applications of classical and quantum statistics
10	Chapter 16: Maxwell distribution of velocities in a gas, particle flux, transport, diffusion
11	Chapter 18: the partition function
12	Chapter 19: quantum statistics, fermions and bosons, limits of classical statistics, calculating the chemical potential
13	Chapter 20: quantum gases (optional time permitting)
14	Chapter 21: blackbody radiation

Note: Lecture schedule is tentative and subject to change