COURSE DESCRIPTION

Thermal and Statistical Physics1

CATHOLIC UNIVERSITY OF KOREA

Course Syllabus

2014학년도 제2학기

Course Title	Korean	열및통계물리학1			
	English	Thermal and Statistical Physics1			
Course Number-Division	01282-01	Course Completion Requirement	제1전공선택	Time/Credits	3/3
Day / Time	월6(M410), 수 4~5(M410)	Course Target Audience		Prerequisite Courses	
Professor	Full Name	Office	Phone Number	E-MAIL	
	마크앤클리프	D327	02-2164-4841	mark.ancliff@gmail.com	
Web Site			English Class		

1.Course Outline

Thermodynamics is the study of temperature and heat, and their relationship with mechanical quantities like pressure and work. The study of thermodynamics played an important part in the industrial revolution, where the theory was used to understand and improve the efficiency of heat engines. Thermodynamics was given a solid theoretical basis by the development of statistical mechanics, which defines the temperature of a system in terms of the statistics of its microstates (a microstate of a system is a complete description of the state of all of its constituent particles).

Thermodynamics and statistical mechanics have applications in nearly all of modern physics, including solid state and condensed matter physics, astronomy and cosmology. This class will cover the foundations of thermodynamics and statistical mechanics in detail, and look at several important applications.

2. Objectives

The aim of this class is to teach students the basics of thermodynamics and statistical mechanics, and to make them confident in applying these theories to various physical systems.

The course will be divided into three parts. The first part of the course will describe the most important results of thermodynamics, the next part will introduce the background knowledge of statistics and quantum mechanics needed for statistical mechanics, and the final part will introduce the theory of statistical mechanics and relate it to the thermodyanical results described in the first part.

No previous experience of these subjects is assumed, but some basic knowledge of mechanics and calculus is necessary.

3. Teaching Method

Last year this class was recorded as part of the universities 'open courseware' project. This year I intend to 'flip' the classroom, so that students will watch the lectures before class and in the class we will do a selection of problem-solving activities, presentations and discussions related to the video lectures.

4. Evaluation Method

Attendance 10%
Participation 10%
Presentations 20%
Midterm Exam 30%
Final Exam 30%

5. Assignments

The homework will be to watch the relevant video lectures each week and fill in a small summary for each one.

6. Experiment, Practical Exercise

None

7. Related Courses

열및?계물리학2

8. Textbook

Book Title	Publisher	Author	Year	Textbook or not
Thermal Physics	Freeman	Kittel and Kroemer	1980	교재
Fundamentals of Physics (8th Edition)	Wiley	Halliday and Resnick	2008	부교재
Introduction to Statistical Physics	Springer	S. R. A. Salinas	2001	부교재

9. Detailed Weekly Activities

Week	Date	Lecture Content	Reference Material	Remarks
1	2014-09-01 ~ 2014-09-07	Course Introduction I: REVIEW OF THERMODYNAMICS Measuring temperature Absolute zero Linear and volume expansion coefficients		
2	2014-09-08 ~ 2014-09-14	Heat and work p-V diagrams The first law of thermodynamics Phases of matter and phase transitions		
3	2014-09-15 ~ 2014-09-21	Heat engines and heat pumps Efficiency of heat engines Ideal gases Isothermal and adiabatic expansions		
4	2014-09-22 ~ 2014-09-28	The equipartition theorem Avagadro's number Entropy The second law of thermodynamics		
5	2014-09-29 ~ 2014-10-05	Heat transfer mechanisms Convection, conduction and radiation Black-body radiation: Planck distribution and Stephan-Boltzmann law		
6	2014-10-06 ~ 2014-10-12	II: BACKGROUND KNOWLEDGE IN STATISTICS AND QUANTUM MECHANICS Introduction to probability theory Definition of mean and variance		
7	2014-10-13 ~ 2014-10-19	The central limit theorem Combinatorics		
8	2014-10-20 ~ 2014-10-26	Midterm Exam		
9	2014-10-27 ~ 2014-11-02	Exam review Review of quantum mechanics Energy levels		

Week	Date	Lecture Content	Reference Material	Remarks
		Bosons and fermions		
10	2014-11-03 ~ 2014-11-09	III: INTRODUCTION TO STATISTICAL MECHANICS The fundamental postulate Statistical definitions of entropy and temperature 'Proof' of the first and second laws of thermodynamics		
11	2014-11-10 ~ 2014-11-16	Concept of the thermodynamic limit The ideal paramagnet Curie's law		
12	2014-11-17 ~ 2014-11-23	The canonical ensemble Helmholtz free energy The paramagnet revisited		
13	2014-11-24 ~ 2014-11-30	The ideal monatomic gas The density of states approximation		
14	2014-12-01 ~ 2014-12-07	Rotational and vibrational modes of an ideal diatomic gas		
15	2014-12-08 ~ 2014-12-14	Heat capacity of an ideal diatomic gas The equipartition theorem revisited Heat capacity of more complex molecules		
16	2014-12-15 ~ 2014-12-21	Final Exam		