Thermal Physics

Course Name	Course type (credit/hours)	Required course(3/3)	Course code	G010
	Target students Division/major/grade	Physics/Junior	Opening semester	2020 2ND SEMESTER
	Class time and classroom	Tue D(Seong337)Thu C(Seong337)	English Grade	A(100%English)
Reference to this course	Prerequisite courses	Classical mechanics, Quantum physics 1, Electromagnetism 1		
	Related basic courses			
	Recommended concurrent courses			
	Related advanced courses	Statistical physics, Solid-state physics, Phase transitions		

Instructor	Name (title/division)	Hosung Seo(Assistant Professor, Energy Systems Research)				
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Teaching Assistant	Name (title/division)					
	Office Room Number		Office phone Number		e-mail	

1. Introduction

Apparently, the physical systems that thermal physics deal with are some physical objects at finite temperature such as liquids or gases at finite temperature, chemical reactions at finite temperature, etc. When working on such systems and trying to predict any of their physical properties, one would immediately encounter many profound and interesting questions: what is temperature? how do we define it? where is energy and heat? when is my system thermalized and reaches thermal equilibrium? Historically, these types of question and basic concepts of thermal physics were largely developed in the nineteenth century and motivated by a desire to understand the underlying mechanisms of the conversion of heat into work using engines. However, thermal physics is a much more general framework than a mere description of heat engines; it describes the effects of temperature on ANY physical objects. Furthermore, thermal physics is intimately intertwined with statistical mechanics, which provides us fundamental insights and also useful tools to understand the underlying microscopic physics of systems at finite temperature. For such reasons, in addition to the fundamental physics point of view, thermal physics plays critical roles in many field of science and technology, ranging from physical chemistry to semiconductor devices, even to information science.

2. Course Objectives

In this course, students will learn the basic concepts and methods of thermal physics and their applications to various problems in modern science and engineering such as chemical reactions, kinetic theory, phase transitions, free energies, and several key issues related to information theory and statistical physics as well.

3. Class types and activities

The course will mainly comprise a series of lectures. Students will be highly encouraged to participate in the lectures by asking questions, discussing concepts and problems dealt during the lectures. I will mainly use the blackboard method, but whenever necessary, I will use a computer, which is very useful specially for showing some real-world demonstrations of interesting physical phenomena. There will be several homework assignments. Students will be encouraged to cooperate with peers to work on the HW problems; more discussions and conversations, better understanding. There will be midterm and final exams. The exams will be designed in such a way that there should be no problem for answering exam questions if students well understand the lecture notes and the HW problems. Attendance and class attitude will be also considered as an important factor.

4. Teaching Method

- [V] lecture
- [V] discussion and debate
- [ ] team project(presentation and case studies)
- [ ] experiments(role-playing,etc)
- [ ] designing and production
- [ ] on-site learning(on-site training)
- [ ] others

5. Support Systems in Use

- [V] AjouBb
- [ ] automatic recording system
- [ ] web-based assignment
- [ ] cyber lecture
- [ ] online content
- [ ] class behavior analyazing system
- [ ] others

6. Teaching Tools

- [V] PBL(Problem Based Learning)
- [V] CBL(Case Based Learning)
- [V] TBL(Team Based Learning)
- [ ] UR(Undergraduate Research)
- [ ] FL(Flipped Learning)
- [ ] DSAL(Data Science Active Learning)
- [ ] others

7. Knowledge and ability required for taking this course

Students are expected to have basic knowledge on classical physics, quantum physics, and electromagnetism at the undergraduate level. But, I will cover those basic topics as much as I can in order to remind students.

8. Method of Evaluation

Evaluation Item	The Number of Times	Evaluation Proportion	Remarks
Attendance		10%	수업태도 포함
midterm exam		35%	
final exam		35%	
quiz		10%	
presentation			
discussion			
homework		10%	
etc			
study hours			

9. Textbook and supplementary material

Main/Sub	Title (Web-site)	Writer	Publisher	Publication year
Main	An introduction to thermal physics	Daniel V. Schroeder	Addison Wesley Longman	2000

10. Class system and Class shedule

< Class Schedule >

* language : K-korean, E-English

Weeks	Topics	language	Instructor	Teaching Method	Evaluation Method	Matter to be prepared
1	Thermal Equilibrium and the ideal gas	E	Hosung Seo	비대면 (동영상 강의)		
2	Heat and Work	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	전주에 제공된 동영상 강의 내용 숙지 및 질문 준비
3	Rates of Processes, kinetic theory	E	Hosung Seo	비대면 (동영상 강의)		

< Class Schedule >

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Weeks	Topics	language	Instructor	Teaching Method	Evaluation Method	Matter to be prepared
4	The second law: two-state systems	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	전주에 제공된 동영상 강의 내용 숙지 및 질문 준비
5	Entropy	E	Hosung Seo	비대면 (동영상 강의)		
6	Temperature	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	전주에 제공된 동영상 강의 내용 숙지 및 질문 준비
7	Equilibrium processes	E	Hosung Seo	비대면 (동영상 강의)		
8	Mid-term exam	E	Hosung Seo	대면 중간 시험	지필고사	1-7주 강의내용 공부
9	Heat Engines	E	Hosung Seo	비대면 (동영상 강의)		
10	Free energy as available work	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	
11	Free energy as a force toward equilibrium	E	Hosung Seo	비대면 (동영상 강의)		
12	Phase transformation	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	
13	Dilute Solutions	E	Hosung Seo	비대면 (동영상 강의)		
14	Chemical Equilibrium	E	Hosung Seo	질의/응답, 대면 강의	퀴즈	
15	Boltzmann statistics	E	Hosung Seo	비대면 (동영상 강의)		
16	Final exam	E	Hosung Seo	대면평가	지필고사	9-15주 강의내용 공부

11. Other items of notification

Another useful reference would be “Concepts in thermal physics” by S. J. Blundell and K. M. Blundel.