MSE 5305 Course Outline (Fall 2016)
Solid State Physics and Thermodynamics of Materials
2:00 pm – 3:20 pm on Monday and Wednesday
Lecture Room: WH 221

Instructor: Seong Jin Koh
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SCOPE This is an introductory and intermediate level course for materials scientists, physicist, chemist, and electrical engineers. This course is comprised of two parts: (1) Solid State Physics, and (2) Thermodynamics and Statistical Mechanics. Solid State Physics in this course is mainly the physics of *crystals*. We will cover the crystal structures of solids, reciprocal lattices, phonons, electronic energy states of solids, optical properties of solids, metals, and semiconductors. For Thermodynamics & Statistical Mechanics, we will study the basic concepts of classical thermodynamics, the introductory statistical mechanics, and the relationship between them. Basic Quantum Mechanics will be introduced where appropriate.

TEXTBOOK Solid State Physics, by N.W. Ashcroft & N.D. Mermin

REFERENCES
Introduction to Solid State Physics, 7th ed., by C. Kittel
Thermal Physics, 2nd ed., by C. Kittel & H. Kroemer
Thermodynamics and an Introduction to Thermostatistics, 2nd ed., by H.B. Callen
Fundamentals of Statistical and Thermal Physics, by F. Reif

EXAM
(a) 2 Midterms and 1 Final: All are closed exams.
(b) You may bring one letter-size paper (an equation sheet), but **you must comply with the following rules**:
- You can use **only the front page** (with you name on it) and the back page must be blank.
- You may put any information you want on the front page (such as formulas, notes, etc.)
- Must be **your own original handwritten** notes.
- **The minimum letter size: Font 12 in Time New Roman (the same as this syllabus).**

(c) For each exam, three must be submitted: 1) **the question sheet, 2) your answer sheet, and 3) your equation sheet. If any of these three is missing, you will get "zero" point.**

GRADE
Homework and Quiz: 5%
Midterms (held in class, one-hour and 50 min.): 25% each
Final (2 hours and 30 min; **Comprehensive**): 45%

HOMEWORK a) Late policy on homework: -10% per day. No credit after three days.
b) I have no objection to study 'groups' and actively encourage you to discuss the solutions among yourselves. **However, this is not a license simply to copy solutions: it is imperative that you understand what you submit, and each student will responsible for defending his or her solutions if necessary! You may not copy any portion of other student's homework or homework solutions from the previous years. You may discuss homework and solution techniques with fellow classmates only after you have attempted to solve the problems. After the discussion you must work on the problems by yourself.**

OFFICE HOUR Tuesday 11:00AM-12:00PM or by an appointment

COURCE SCHDULE
The dates are approximate.
A&M: Ashcroft & Mermin

Class	Date	Subject	Chapter
1	8/29	Drude Theory of Metals	A&M 1
2	8/31	Drude Theory of Metals	A&M 1
3	9/7	Introduction to Quantum Mechanics and Statistical Physics	
4	9/12	Sommerfield Theory of Metals	A&M 2-3, K6
5	9/14	Sommerfield Theory of Metals	A&M 2-3, K6
6	9/19	Crystal Lattice	A&M 4&7, K1
7	9/21	Reciprocal Lattice, X-ray Diffraction	A&M 5-6, K2
8	9/26	Reciprocal Lattice, X-ray Diffraction	A&M 5-6, K2
9	9/28	Bloch's Theorem, Band Theory	A&M 8, K7
10	10/3	Bloch's Theorem, Band Theory	A&M 8, K7
11	10/5	Electrons in a weak Periodic Potential	
12	10/10	**1st Midterm**	A&M 9
13	10/12	Band Theory	A&M 9
14	10/17	Tight-Binding Method	A&M 10
15	10/19	Tight-Binding Method	A&M 10
16	10/24	Overview of Statistical Mechanics and Thermodynamics	
17	10/26	Entropy, Temperature, Free Energy	
18	10/31	Partition Function	
19	11/2	Microcanonical Formalism, Canonical Formalism, Grand Canonical Formalism	
20	11/7	Fermi-Dirac Distribution, Bose-Einstein Distribution	
21	11/9	Classical Thermodynamics and its postulates	
22	11/14	**2nd Midterm**	
23	11/16	Entropy, Temperature, Internal Energy, Free Energy	
24	11/21	Euler equation, Gibbs-Duhem relation	
25	11/23	Legendre transformation, Helmholtz Free Energy, Gibbs Free Energy	
26	11/28	First, second, third laws of thermodynamics, Nernst Postulate	
27	11/30	Maxwell relations and Thermodynamic Square	
28	12/5	Examples of Thermodynamic Problems	
29	12/7	Review	
30	12/12	**Final (2:00PM-4:30PM)**	

American with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the sprit and letter of federal equal opportunity legislation; reference Public Law 93112-The Rehabilitation Act of 1973 as amended. With the passage of new federal legislation entitles Americans with Disabilities Act (ADA, pursuant to section 504 of the Rehabilitation Act), there is renewed focus on providing this population with the same opportunities enjoyed by all citizens. As a faculty member, I am required by law to provide "reasonable accommodation" to students with disabilities, so as not to discriminate on the basis of that disability. Student responsibility primarily rests with informing faculty at the beginning of the semester and in providing authorized documentation through designated administrative channels.

Academic Integrity: It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. Any person involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. It is your responsibility to know University policies on these matters. "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts." (Regents' Rules and Regulations, Part One, Chapter VI, Section 3, Subsection 3.2, Subdivision 3.22)

You may not copy any portion of another student's homework or the homework solutions from last year. You may discuss homework and solution techniques with a fellow classmate only after you have attempted to solve the problem. After the discussion you must work the problem by yourself.