



Course Syllabus: Electronic Properties of Materials - MSE 302

Division	Physical Science and Engineering Division
Course Number	MSE 302
Course Title	Electronic Properties of Materials
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	09:00 AM - 10:30 AM Sun Tue

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Lain-Jong Li	lance.li@kaust.edu.sa	+966128084665	3337, 5, Al-Kindi (bldg. 5)	appointment by e-mail

Teaching Assistant(s)

Name	Email
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Course Information

Comprehensive Course Description

Course Objectives

This course offers an overview of the electronic properties of materials. There is an emphasis in lectures on fundamental physical models to understand the crystal structure and bonding, band structure of solids, carrier properties and p-n junctions. With the basis, students will be able to have clear concepts on electrical behaviors of metals and semiconductors. This course will also introduce key electronic devices based on homo p-n junctions and hetero-junctions. A brief review of thermal and phonon properties will be given. .

Course Topics

- Crystal Structure & Diffraction
- Structure of Atom
- Bonding in Materials
- Band Formation
- Electron, Holes and current
- Junctions
- Semiconductor Devices
- Light Emission and Detection
- Thermal Properties and Phonons
- Novel Materials

Course Description from Program Guide	This course offers an overview of the electronic, optical, magnetic and thermal properties of materials, not limited to solid state. It covers the fundamental concepts of band structure and bonding of materials, electrical and thermal conduction in metals, semiconductors and dielectric. The interaction between light and matter will be addressed and important concepts such as excitons will be introduced. Finally magnetism will be introduced.
Goals and Objectives	This course offers an overview of the electronic properties of materials. There is an emphasis in lectures on fundamental physical models to understand the crystal structure and bonding, band structure of solids, carrier properties and p-n junctions. With the basis, students will be able to have clear concepts on electrical behaviors of metals and semiconductors. This course will also introduce key electronic devices based on homo p-n junctions and hetero-junctions. A brief review of thermal and phonon properties will be given. .
Required Knowledge	No official pre-requisite, but prior exposure to electronic materials or solid state physics class will be useful.
Reference Texts	Textbook Lecture notes and tutorial sheets Reference Books Solid State Physics Ashcroft / Mermin *Principles of Semiconductor Devices Neamen
Method of evaluation	20.00% - Scientific review article presentation 40.00% - Exam 2 40.00% - Exam 1
Nature of the assignments	student will need to select literature (SCI journal article) which is closely related to the taught topics for presentation
Course Policies	Exams and presentations are reuquired
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/22/2017 Tue 01/24/2017	Introduction of the course structure, grading and requirements Crystal Structure
2	Sun 01/29/2017 Tue 01/31/2017	Reciprocal Lattice & Diffraction Structure of atom/Bonding in materials
3	Sun 02/05/2017 Tue 02/07/2017	Band Formation
4	Sun 02/12/2017 Tue 02/14/2017	Properties of Electron and Holes < distribution of problem sheet 1 > Electrical current
5	Sun 02/19/2017 Tue 02/21/2017	* Discussions on Problem Sheet 1 Homojunction
6	Sun 02/26/2017 Tue 02/28/2017	Homojunction <distribution of problem sheet 2> Heterojunction
7	Sun 03/05/2017 Tue 03/07/2017	* Discussions on Problem Sheet 2 Metal-Semiconductor Junction
8	Sun 03/12/2017 Tue 03/14/2017	Metal-Semiconductor Junction Review for examination
9	Sun 03/19/2017 Tue 03/21/2017	Mid-term Exam (9:00-11:00 am) (40%) Metal-Semiconductor Junction <distribution of problem sheet 3>
10	Sun 03/26/2017 Tue 03/28/2017	* Discussions on Problem Sheet 3
11	Sun 04/02/2017 Tue 04/04/2017	No lecture (Holidays) No lecture (Holidays)
12	Sun 04/09/2017 Tue 04/11/2017	Presentation Presentation
13	Sun 04/16/2017 Tue 04/18/2017	Presentation Semiconductor devices
14	Sun 04/23/2017 Tue 04/25/2017	Semiconductor devices < distribution of problem sheets 4 > Light detection and emissions
15	Sun 04/30/2017 Tue 05/02/2017	* Discussions on Problem Sheet 4 Bipolar junction and other transistors
16	Sun 05/07/2017 Tue 05/09/2017	Bipolar junction and other transistors Review for final exam
17	Sun 05/14/2017 Tue 05/16/2017	Final Exam (9:00-11:00 am) (40%)
18		

Note

The instructor reserves the right to make changes to this syllabus as necessary.