



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	2017/2018
Semester Start Date	01/28/2018
Semester End Date	05/24/2018
Class Schedule (Days & Time)	09:00 AM - 10:30 AM Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Husam Niman Alshareef	husam.alshareef@kaust.edu.sa	+966128084477	2228, 3, Ibn Sina (bldg. 3)	appointment by e-mail

Teaching Assistant(s)

Name	Email
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Course Information

Comprehensive Course Description	<p>This course offers an overview of the electronic, optical, and thermal properties of materials. It covers the fundamental concepts of band structure and bonding of materials, electrical and thermal conduction in metals, semiconductors and dielectrics. The interaction between light and matter will be addressed and important concepts introduced.</p> <p><u>Specific topics that will be covered include:</u></p> <ul style="list-style-type: none"> Crystal Structures & Lattices Reciprocal Lattice Free Electron Theory Introductory Band Theory Semiconductor Materials Dielectric Materials Electronic Devices Introductory Phonons & Thermal Properties Introductory Light Matter Interactions
Course Description from Program Guide	<p>The objective of this course is to present the fundamental concepts of structural, electrical and optical properties needed to understand the behavior of the materials. The course includes a brief description of crystal structure of solids, and the basics of x-ray diffraction theory; free electron theory in metal and band theory will be addressed. A brief review of thermal and lattice vibration properties will be presented. A brief introduction on key electronic devices based on homo p-n junctions and hetero-junctions. A Brief description of dielectric materials.</p>
Goals and Objectives	<ul style="list-style-type: none"> Understand structure of materials, bonding, symmetry, reciprocal lattice, and Diffraction Understand free electron, band, and dielectric relaxation theories Understand the electronic properties of metals, semiconductors, and insulators Understand lattice waves, the quantization of phonons and thermal properties of materials Understand fundamentals of light interaction with solids, and optical properties in the context of band structure of solids

Required Knowledge	No official pre-requisite, but prior exposure to undergraduate physics classes or solid state physics class will be useful.
Reference Texts	<p>Textbook Lecture Notes & Handouts</p> <p>Reference Books Principles of Electronic Materials and Devices, S. O. Kasap Electronic Properties of Materials, Rodolf Hummel Introduction to Solid State Physics, Charles Kittel Solid State Electronic Devices, Ben Streetman & Sanjay Banerjee</p>
Method of evaluation	<p>50.00% - Final exam 30.00% - Midterm exam 20.00% - Homework /Assignments</p>
Nature of the assignments	Homework problem sets
Course Policies	<p>Late homework not accepted Make-up exams will be given only in exceptional circumstances</p>
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Mon 01/29/2018	Crystal Structures
1	Wed 01/31/2018	Crystal Structures
2	Mon 02/05/2018	Reciprocal Lattice
2	Wed 02/07/2018	Reciprocal Lattice
3	Mon 02/12/2018	Bonding in Materials
3	Wed 02/14/2018	Bonding in Materials
4	Mon 02/19/2018	Free Electron Model
4	Wed 02/21/2018	Free Electron Model
5	Mon 02/26/2018	Free Electron Model
5	Wed 02/28/2018	Band Theory & Band Structure
6	Mon 03/05/2018	Band Theory & Band Structure
6	Wed 03/07/2018	Band Theory & Band Structure
7	Mon 03/12/2018	Band Theory & Band Structure
7	Wed 03/14/2018	Semiconductor Materials
8	Mon 03/19/2018	Exam
8	Wed 03/21/2018	Semiconductor Materials
9	Mon 03/26/2018	Semiconductor Devices
9	Wed 03/28/2018	Semiconductor Devices
10	Mon 04/02/2018	Spring Break
10	Wed 04/04/2018	Spring Break
11	Mon 04/09/2018	Semiconductor Devices
11	Wed 04/11/2018	Semiconductor Devices
12	Mon 04/16/2018	Dielectric Materials & Physics
12	Wed 04/18/2018	Dielectric Materials & Physics
13	Mon 04/23/2018	Dielectric Materials & Physics
13	Wed 04/25/2018	Dielectric Materials & Physics
14	Mon 04/30/2018	Phonons & Thermal Properties
14	Wed 05/02/2018	Phonons & Thermal Properties
15	Mon 05/07/2018	Phonons & Thermal Properties
15	Wed 05/09/2018	Phonons & Thermal Properties
16	Mon 05/14/2018	Optical Properties
16	Wed 05/16/2018	Optical Properties
17	Mon 05/21/2018	Optical Properties
17	Wed 05/23/2018	Final

Note

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