جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Semiconductor Materials - MSE 322

Division	Physical Science and Engineering Division
Course Number	MSE 322
Course Title	Semiconductor Materials
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	01:00 PM - 02:30 PM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Iman Salem Roqan	iman.roqan@kaust.edu.sa	+966128084340	R-3221 (sea-side), 3, Ibn Sina (bldg. 3)	Sunday 12-1.30 pm Monday 3-4 pm Wednesday 3-4pm Thursday 12-1.30 pm

Teaching Assistant(s)

Name	Email
N/A	N/A

Course Information

Comprehensive Course Description	This course is advanced semiconductor course that focus on understanding the physical, optical and structural properties of semiconductor materials including semiconductor alloys, amorphous semiconductors, organic semiconductors and nanostructure semiconductors. The applications of these semiconductors will be briefly described. In addition, the physics of several growth and characterization techniques will be taught for the students. The class will involve practical lab work. In the end of this course the student should have a good understanding on the semiconductor properties and most important growth and characterization techniques.
Course Description from Program Guide	The course covers the physico-chemical and electronic properties of advanced semiconductor materials other than Si and GaAs. The materials that will be covered include elemental semiconductors such as Ge and carbon (in the form of carbon nanotubes and graphene), compound semiconductors such as III-V and II-VI compounds, and wide-band gap semiconductors such as carbides and nitrides. Special classes of semiconductors such as oxides, chalcogenides, and polymeric semiconductors will be included. In each material category, the material processing and fabrication of select devices will be discussed including 1-dimensional and 2-dimensional devices. Measurement protocols for the devices will be presented.

Goals and Objectives	At the end of this course students will be able -Understand the Engineering of the electronic band structure and crystal structure of semiconductor materials. -Interpret the semiconductor alloys and bandgap bowing. -Understand amorphous semiconductor band structure and electrical behavior. -Explain optical properties of semiconductor nanostructure. -Understand the optical mechanism of organic semiconductor and the related devices. -Be familiar with the optical and structural characterization techniques and the related lab work
Required Knowledge	Students should be familiar with the contents of, 1- Electronic properties of materials or equivalent 2- Quantum mechanics 3- Thermodynamics
Reference Texts	Textbooks -The Materials Science of Semiconductors by Angus Rockett -The Physics of Semiconductors: An Introduction Including Nanophysics and Applications by Marius Grundmann -Optical properties of Solid by Mark Fox -Semiconductor material and device characterization by Dieter K. Schroder Reference books -Electronics structures and the properties of Solids: physics of chemical bonds by Harrison. -Electrical properties of materials by Solymar -Advance semiconductor fundamentals by Pierret -Introduction to solid state physics by Kittel
Method of evaluation	**5.00**% - Written report **10.00**% - Research Project **5.00**% - Quiz(zes) **5.00**% - Presentation **25.00**% - Midterm exam **15.00**% - Homework /Assignments **35.00**% - Final exam
Nature of the assignments	**Homework:** Book problems **Written report**: literature review on a related topic **Presentation:** presenting advance topic that is related to the course **Research project**: A Laboratory report as the class will content a lab work **Quiz(zes):** I will require a sudden quiz from time to time to examin the understanding of the student **Midterm exam**: will be taken on April **Final Exam:** will be taken in the end of the semester.
Course Policies	Students should attend all sessions (frequent absence will be penalized in up to 5% of final grade). Additional class for tutorials after each chapter Students should carry out our laboratory work Student must be prapared to have a quiz any time
Additional Information	Lectures will be conducted by using PowerPoint slides

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 01/23/2017 Wed 01/25/2017	Quick revision: Band Theory (Solutions of the Schrodinger Equation)
2	Mon 01/30/2017 Wed 02/01/2017	Engineering of the band structure of different types of semiconductors +Tutorials
3	Mon 02/06/2017 Wed 02/08/2017	Engineering of the band structure of different types of semiconductors +Tutorials
4	Mon 02/13/2017 Wed 02/15/2017	Engineering of Semiconductor alloys including metastable materials and applications +Tutorials
5	Mon 02/20/2017 Wed 02/22/2017	Band structure of amorphous semiconductor
6	Mon 02/27/2017 Wed 03/01/2017	The optical and electrical properties of amorphous semiconductor + Tutorials
7	Mon 03/06/2017 Wed 03/08/2017	Crystal Growth and Epitaxy and the related thermodynimics + Tutorials
8	Mon 03/13/2017 Wed 03/15/2017	**Revision+ Mid term exam**
9	Mon 03/20/2017 Wed 03/22/2017	The mechanism of structural defects and their effect on the band transition+ tutorials
10	Mon 03/27/2017 Wed 03/29/2017	Optical properties of Semiconductor and excitonic behavior (basics) + Tutorials
11	Mon 04/03/2017 Wed 04/05/2017	**Student Spring Break**
12	Mon 04/10/2017 Wed 04/12/2017	The physics of quantum well, quantum dot and nanowires semiconductor including the optical properties +Tutorials
13	Mon 04/17/2017 Wed 04/19/2017	Organic semiconductors + Tutorials
14	Mon 04/24/2017 Wed 04/26/2017	Optical, electrical and structural characterization techniques + Lab work starting
15	Mon 05/01/2017 Wed 05/03/2017	Lab work
16	Mon 05/08/2017 Wed 05/10/2017	Lab work ending + **Revisions**
17	Mon 05/15/2017 Wed 05/17/2017	**The final Exam**
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Note

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