



## Course Syllabus: Semiconductor Materials - MSE 322

<b>Division</b>	Physical Science and Engineering Division
<b>Course Number</b>	MSE 322
<b>Course Title</b>	Semiconductor Materials
<b>Academic Semester</b>	Spring
<b>Academic Year</b>	2018/2019
<b>Semester Start Date</b>	01/27/2019
<b>Semester End Date</b>	05/23/2019
<b>Class Schedule</b> (Days & Time)	01:00 PM - 02:30 PM   Wed Thu

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)	Monday 9-11am Tuesday 9-11am Sunday 1-3pm

Teaching Assistant(s)	
Name	Email

Course Information	
<b>Comprehensive Course Description</b>	This course is advanced semiconductor course that focus on understanding the physical, optical and structural properties of semiconductor materials including semiconductor alloys, amorphous 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.
<b>Course Description from Program Guide</b>	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.
<b>Goals and Objectives</b>	At the end of this course students will be able <ul style="list-style-type: none"> <li>-Understand the Engineering of the electronic band structure and crystal structure of semiconductor materials.</li> <li>-Interpret the semiconductor alloys and bandgap bowing.</li> <li>-Understand amorphous semiconductor band structure and electrical behavior.</li> <li>-Explain optical properties of semiconductor .</li> <li>-Be familiar with the optical and structural characterization techniques and the related lab work</li> </ul>
<b>Required Knowledge</b>	Students should be familiar with the contents of, Electronic properties of materials or equivalent Quantum mechanics Thermodynamics

<b>Reference Texts</b>	<p>The textbooks</p> <ul style="list-style-type: none"> <li>-The Materials Science of Semiconductors by Angus Rockett</li> <li>-The Physics of Semiconductors: An Introduction Including Nanophysics and Applications by Marius Grundmann</li> <li>-Optical properties of Solid by Mark Fox</li> <li>-Semiconductor material and device characterization by Dieter K. Schroder</li> </ul> <p>Addition reference books</p> <ul style="list-style-type: none"> <li>-Electronics structures and the properties of Solids: physics of chemical bonds by Harrison.</li> <li>-Electrical properties of materials by Solymar</li> <li>-Advance semiconductor fundamentals by Pierret</li> <li>-Introduction to solid state physics by Kittel</li> </ul>
<b>Method of evaluation</b>	50.00% - Final exam
<b>Nature of the assignments</b>	<ul style="list-style-type: none"> <li>-Exams</li> <li>-literature review</li> <li>-presentations</li> <li>-Homeworks</li> </ul>
<b>Course Policies</b>	<p>Students should attend all sessions (frequent absence will be penalized in up to 5% of final grade). Additional class may took place for tutorials after each chapter</p>
<b>Additional Information</b>	<p>As it is an advance topic, students who did not have the background knowledge on quantum mechanics and thermodynamics will be not able to follow the classes without these knowledge that may affect their performance in the class</p>

## Tentative Course Schedule

*(Time, topic/emphasis & resources)*

Week	Lectures	Topic
1	Wed 01/30/2019	Band Theory (Solution of the Schrodinger Equation)
1	Thu 01/31/2019	Band Theory (Solution of the Schrodinger Equation)
2	Wed 02/06/2019	Engineering of the band structure of different types of semiconductors
2	Thu 02/07/2019	Engineering of the band structure of different types of semiconductors
3	Wed 02/13/2019	Engineering of the band structure of different types of semiconductors
3	Thu 02/14/2019	Tutorials
4	Wed 02/20/2019	Engineering of Semiconductor alloys including metastable materials and applications
4	Thu 02/21/2019	Engineering of Semiconductor alloys including metastable materials and applications
5	Wed 02/27/2019	Tutorials
5	Thu 02/28/2019	Band structure of amorphous semiconductor
6	Wed 03/06/2019	The electronic properties of amorphous semiconductor
6	Thu 03/07/2019	The optical and electrical properties of amorphous semiconductor
7	Wed 03/13/2019	Tutorials
7	Thu 03/14/2019	Crystal Growth and Epitaxy
8	Wed 03/20/2019	Tutorials +Revision
8	Thu 03/21/2019	Mid term exam
9	Wed 03/27/2019	Spring Break
9	Thu 03/28/2019	Optical properties of Semiconductor and excitonic behavior
10	Wed 04/03/2019	Optical properties of Semiconductor and excitonic behavior
10	Thu 04/04/2019	Tutorials
11	Wed 04/10/2019	The physics of nanostructures semiconductor
11	Thu 04/11/2019	The physics of nanostructures semiconductor
12	Wed 04/17/2019	Optical, electrical and structural characterization techniques
12	Thu 04/18/2019	Optical, electrical and structural characterization techniques
13	Wed 04/24/2019	Tutorials
13	Thu 04/25/2019	Optical, electrical and structural characterization techniques
14	Wed 05/01/2019	Optical, electrical and structural characterization techniques
14	Thu 05/02/2019	Tutorial and discussions
15	Wed 05/08/2019	Student presentations
15	Thu 05/09/2019	Revisions
16	Wed 05/15/2019	Revisions
16	Thu 05/16/2019	<b>The final in the Exam week</b>
17	Wed 05/22/2019	Final Exam Week
17	Thu 05/23/2019	Final Exam Week

### Note

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