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

Course Syllabus: Electronic and Optical Prop of Semicond. - EE 306

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 306
Course Title	Electronic and Optical Prop of Semicond.
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 | Tue Thu

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Kazuhiro Ohkawa	kazuhiro.ohkawa@kaust.edu.sa	+966128080701	2226, 3, Ibn Sina (bldg. 3)	Thursday 4-6pm. If you need other time slots, please email me.

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	This course deals with optical and electrical properties of semiconductors including their characterization methods. Every semiconductor has a unique value of bandgap based on its atomic arrangement as crystal. Impurities in semiconductors are the origin of additional carriers which occupies the major electrical properties. The impurities influence optical property as well. We will study not only n- or p-type semiconductor but also their heterostructures and quantum structures. The knowledge of these fields is valuable to judge material quality, understand device operation, and design new devices.
Course Description from Program Guide	The course discusses in detail the theory behind important semiconductor based experiments such as Hall effect and Hall mobility measurement, velocity-field measurement, photoluminescence, gain, pump-probe studies, pressure and strain dependent studies. Theory will cover: Band structure in quantum wells; effect of strain on band structure; transport theory; excitons, optical absorption, luminescence and gain.
Goals and Objectives	Students are expected to acquire sufficient knowledge of semiconductors as materials and devices. Students will 1. review basic of solid state physics 2. study crystal structures and bandgaps 3. understand origin of carriers and their dynamics 4. learn optical transition phenomena in semiconductors including their characterization technologies.
Required Knowledge	Solid state physics
Reference Texts	C. Kittel, "Introduction to Solid State Physics", Wiley Others will be announced in the class.
Method of evaluation	**15.00**% - Written report **45.00**% - Quiz(zes) **20.00**% - Final exam **20.00**% - Attendance and Participation

Nature of the assignments	Students must work independently on their report, presentation, homework, and other assignments.
Course Policies	Late homework and assignments will not be evaluated.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Tue 01/30/2018 Thu 02/01/2018	Introduction of semiconductor physics Fermion and Fermi-Dirac distribution function
2	Tue 02/06/2018 Thu 02/08/2018	Density of states (3D, 2D, 1D) Density of states (quantum well, wire, dot)
3	Tue 02/13/2018 Thu 02/15/2018	Heat capacity of the electron gas Wiedemann-Franz law
4	Tue 02/20/2018 Thu 02/22/2018	Quiz 1 Ionic and covalent bonds
5	Tue 02/27/2018 Thu 03/01/2018	Semiconductor structures Origin of bandgap 1
6	Tue 03/06/2018 Thu 03/08/2018	Origin of bandgap 2, 3
7	Tue 03/13/2018 Thu 03/15/2018	Drawing Bandgap Reduced zone scheme
8	Tue 03/20/2018 Thu 03/22/2018	A shape of bandgap 1, 2
9	Tue 03/27/2018 Thu 03/29/2018	Number of states in a band Quiz 2
10	Tue 04/03/2018 Thu 04/05/2018	Spring break
11	Tue 04/10/2018 Thu 04/12/2018	Electrical property (effective mass) Intrinsic semicondutor
12	Tue 04/17/2018 Thu 04/19/2018	Carrier transport in heterostructures
13	Tue 04/24/2018 Thu 04/26/2018	High electron mobility transistors
14	Tue 05/01/2018 Thu 05/03/2018	Tunnel junction
15	Tue 05/08/2018 Thu 05/10/2018	Photoabsorption phenomena
16	Tue 05/15/2018 Thu 05/17/2018	Photoabsorption devices
17	Tue 05/22/2018 Thu 05/24/2018	Exam
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Note

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