Course Syllabus: Special Topics in Solid State Devices - EE 390B

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 390B
Course Title	Special Topics in Solid State Devices
Academic Semester	Spring
Academic Year	2018/2019
Semester Start Date	01/27/2019
Semester End Date	05/23/2019
Class Schedule (Days & Time)	01:00 PM - 04:00 PM | Sun

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Xiaohang Li	xiaohang.li@kaust.edu.sa		3, Ibn Sina (bldg. 3)	10am-12pm, Saturdays. Please email me before coming since I am typically around the lab instead of being in the office.

Teaching Assistant(s)

Name	Email
Rongyu Lin	rongyu.lin@kaust.edu.sa

Course Information

Comprehensive Course Description	The wide-bandgap semiconductor, also known as the third-generation semiconductor, is among the most invested and active research fields around the globe. Because of its superior optical and electronic properties as well as high stability, it has been deployed in almost every product that runs on electricity. As a result, hundreds of billions of dollars of economy and massive employment opportunities have been created. The Nobel Prize in Physics 2014 awarded to the inventors of blue LED is a direct result of the wide-bandgap semiconductor research. However, the research is still at its infancy with numerous unexplored territories and enormous opportunities ahead. This course will focus on cutting-edge research of wide bandgap semiconductor optical and electronic devices. Each student would have the opportunity of diving deep into one sub research topic and strive to become an expert. The course study will be closely related to the ongoing research of Advanced Semiconductor Lab at KAUST and many leading labs in the world. Thus, the students will be able to potentially author scientific papers. The course teaching will implement active learning to cultivate students' enthusiasm, higher-order thinking ability, and intellectual agility, which are critical for becoming a successful scientist or engineer. Out of many potential applications of III-nitride semiconductors, UV LED is regarded as the key technology to chemical curing and produce clean water & air. The market potentials are enourmous. However, its efficiency today is 40 times lower than that of blue LED. Specifically, the students are expected to use a software to design UV LED emitting at 280 nm by using polarization engineering with the goal of improving its internal quantum efficiency (IQE) compared to a conventional design. The IQE comprises two parts: carrier injection effiiency and radiative recombination efficiency. The polarization is a unique property the III-nitride semiconductors possess. It can either bend up or down conduction and valence bands, thereby changing how electrons and holes move and recombine. Thus it can play in key role in enhancing or lowering the carrier injection effiiency and radiative recombination efficiency.
Course Description from Program Guide	
Goals and Objectives	Students will develop a strong background in the wide bandgap semiconductor device research and even coauthor journal papers. Equally important, the students will possess necessary 'soft skills' to excel in future career.

Required Knowledge	Prerequisites of this course include EE206 and EE208, or equivalent courses. If you have taken them before, you are very welcome to take the course. Otherwise it would be very challenging for you.
Reference Texts	Updated references comprising mostly journal papers and book chapters would be sent out by emails.
Method of evaluation	**75.00**% - Course Project(s) **15.00**% - Presentation **10.00**% - Active participation
Nature of the assignments	There will be no assignment or homework.
Course Policies	We will meet once per week to discuss progress. There is no policy or punishment for absence, assignment or late work. The students are adults and are expected to make decisions for their best interest.
Additional Information	

Tentative Course Schedule
(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 01/27/2019	Introduction
2	Sun 02/03/2019	Research project study and discussion
3	Sun 02/10/2019	Research project study and discussion
4	Sun 02/17/2019	Research project study and discussion
5	Sun 02/24/2019	Research project study and discussion
6	Sun 03/03/2019	Research project study and discussion
7	Sun 03/10/2019	Research project study and discussion
8	Sun 03/17/2019	Research project study and discussion
9	Sun 03/24/2019	Spring Break
10	Sun 03/31/2019	Research project study and discussion
11	Sun 04/07/2019	Research project study and discussion
12	Sun 04/14/2019	Research project study and discussion
13	Sun 04/21/2019	Research project study and discussion
14	Sun 04/28/2019	Research project study and discussion
15	Sun 05/05/2019	Research project study and discussion
16	Sun 05/12/2019	Research project study and discussion
17	Sun 05/19/2019	Final Exam Week

Note

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