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

Course Syllabus: Special Topics in Photonics - EE 390D

Division	Computer, Electrical and Mathematical Sciences & Engineering
Course Number	EE 390D
Course Title	Special Topics in Photonics
Academic Semester	Fall
Academic Year	2019/2020
Semester Start Date	08/25/2019
Semester End Date	12/10/2019
Class Schedule (Days & Time)	10:30 AM - 12:00 PM | Sun Tue

Instructor(s)

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

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	New devices are often developed based on new materials. To realize new device structures and/or high-quality materials, growth technology is one of the key points to fulfill the inventors' ideas. It is important to understand the physics and chemistry of crystal growth to develop new devices. The course deals with the essence of crystal growth, physical and chemical points of view of the phenomena, their device applications. This course is intended for Ph.D. students, but also master students are welcome.
Course Description from Program Guide	
Goals and Objectives	Students are expected to acquire sufficient knowledge of semiconductor epitaxy and crystal growth for devices. Students will 1. know different type of crystal growth technologies 2. understand physics and chemistry of crystal growth 3. gain the knowledge of liquid-phase epitaxy, molecular beam epitaxy, and metalorganic vapor-phase epitaxy 4. learn binary and ternary alloys and their properties 5. learn growth of device structures by using different growth technologies.
Required Knowledge	Semiconductor fundamentals Basic of vacuum, inorganic chemistry, hydrodynamics, and molecular dynamics
Reference Texts	"Organometallic vapor-phase epitaxy" by Gerald B. Stringfellow, Academic press. "Semiconductor devices" by S. M. Sze and M. K. Lee, Wiley
Method of evaluation	**20.00**% - Written report **30.00**% - Presentation **20.00**% - Homework /Assignments **30.00**% - 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 accepted.
Additional Information	

Tentative Course Schedule

(Time, topic/emphasis & resources)

Week	Lectures	Topic
1	Sun 08/25/2019 Tue 08/27/2019	Introduction of device structures, epitaxial technologies
2	Sun 09/01/2019 Tue 09/03/2019	Microscopic concept of growth mode
3	Sun 09/08/2019 Tue 09/10/2019	Si bulk and thin-film growth technologies
4	Sun 09/15/2019 Tue 09/17/2019	GaAs liquid-phase epitaxial growth Thermal problem in GaAs laser diodes
5	Sun 09/22/2019 Tue 09/24/2019	National Day Physics of alloy compounds
6	Sun 09/29/2019 Tue 10/01/2019	Optical gain in the laser structure Population inversion, optical confinement
7	Sun 10/06/2019 Tue 10/08/2019	Laser photon-electron interaction Self-sustained pulsation
8	Sun 10/13/2019 Tue 10/15/2019	Growth kinetics Surface observation
9	Sun 10/20/2019 Tue 10/22/2019	Mean free path of molecules GaAs molecular-beam epitaxy
10	Sun 10/27/2019 Tue 10/29/2019	Hole current in p-GaAs/p-AlGaInP junction p-InGaP interlayer to divide a large barrier
11	Sun 11/03/2019 Tue 11/05/2019	Surface migration Band diagram of pn junction
12	Sun 11/10/2019 Tue 11/12/2019	Introduction of metalorganic vapor phase epitaxy The principle of chemical vapor deposition
13	Sun 11/17/2019 Tue 11/19/2019	Gas flow Compressible viscous flow
14	Sun 11/24/2019 Tue 11/26/2019	Chemical reactions, collision diameter Chemical rate parameters
15	Sun 12/01/2019 Tue 12/03/2019	Thermal radiation and thermal contacts
16	Sun 12/08/2019 Tue 12/10/2019	Presentation and report

Note

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