Advanced topics: Optical Properties of Semiconductors - Course Syllabus

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Course Number: MSE 392

Course Title: Advanced topics: Optical Properties of Semiconductors

Academic Semester:	Spring	**Academic Year:**	2015/ 2016
Semester Start Date:	Jan 24, 2016	**Semester End Date:**	May 19, 2016

Class Schedule: Tuesday and Thursday

Classroom Number:

Instructor(s) Name(s): Prof Iman Roqan
Email: iman.roqan@kaust.edu.sa

Office Location: Blg3, Room 3221 (Sea side)
Office Hours: Every Sunday-Monday-Wednesday (10-12)

COURSE DESCRIPTION FROM PROGRAM GUIDE

Lecture-based class.

COMPREHENSIVE COURSE DESCRIPTION

The course will cover the optical physics of semiconductors. The course includes the quantum theory of the absorption and luminescence phenomena in semiconductors. The exciton effects will be addressed. Quantum confinement of quantum well and nanostructure semiconductors will be covered including a brief description of luminescence centers of some metallic dopants in semiconductors. The quantum theory treatment of luminescence related to phonon absorption will be included. The course will be ended by a brief introduction to nonlinear crystals and optical properties of new semiconductor materials.

Lecture 1 introduction to optical materials and characteristic of optical physics in solid states

Lecture 2 classical propagation

Lecture 3-4 Optical absorption in semiconductor

Lecture 5-6 Excitons

Lecture 7-8 luminescence in semiconductors

Lecture 9 Optical behaviors of dopants and defects in semiconductor’s

Lecture 10 Tutorials

Lecture 11-12 Quantum confinement effect in nanostructures

Lecture 13 Midterm Exam

Lecture 14-15 Free electrons and Plasmonic effect

Lecture 16-17 luminescence centers of some metallic dopants in semiconductors

Lecture 18-19 Phonon absorption

Lecture 20 Tutorials

Lecture 21-22 Nonlinear optical properties

Lecture 23-24 optical properties of new emerging semiconductors

Lecture 25-26 Tutorials

Lecture 27 Revision

Final exam

GOALS AND OBJECTIVES

1. to understand the quantum theory of absorption and emission in semiconductor including defects and excitonic effects

2. to understand the effect of quantum confinement in nanostructural semiconductors

3. to understand the complex optical phenomena related to optical centers and phonon absorptions

4. to understand the nonlinear optical properties.

REQUIRED KNOWLEDGE

Solid state physics

Quantum physics

Atomic physics

REFERENCE TEXTS

Text book: Optical properties of Solids by Mark Fox

Reference books

Introduction to Solid State Physics by Kittel

METHOD OF EVALUATION

Graded content
Home works 15% Midterm exam and final exam 85%

COURSE REQUIREMENTS

Assignments

Written assignments
Paper presentations

Course Policies

No absence without a written excuse
Assignments must be delivered on deadlines

Additional Information

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