

## **Course syllabus**

### **Basic Information:**

*Course title (中文):* 有機光電材料科學特論

*Course title (English):* Special Topics in Materials science for organic optoelectronics

*Instructor:* 大江昌人(Oh-e, Masahito) ([oh-e@ee.nthu.edu.tw](mailto:oh-e@ee.nthu.edu.tw)) @台達館#838

*Language for teaching:* English

*Class time:* R3R4F2      *Location:* DELTA 台達 208

### **Course Description:**

This course is constructively prepared for graduate and senior undergraduate students. This course provides materials science related to optoelectronic devices technology. If time permitted, the course will also offer characterization of thin films including analytical probing methods of molecular orientation with related optics and physics. Before we explore the fundamentals of optoelectronic devices\*, it is prerequisite for us to have fundamental knowledge on materials and the related areas since optoelectronic devices are composed of interdisciplinary technologies. This course covers quantum chemistry from atoms to molecules, quantum mechanical frameworks for materials science, physics and chemistry of materials including photo-physical processes of molecules, light-matter interactions, molecule-molecule interactions and other materials related topics. In the end of the course, if time permitted, we will also focus on the research area on characterization of thin films including molecular orientation, which is related to optoelectronic devices at surfaces/interfaces and in the bulk of thin films. We will study how properties of thin films influence on devices and how we can probe molecular orientations using linear and nonlinear optical spectroscopy.

\* These matters will be provided in “Selected topics in organic optoelectronics: physics, materials and devices” (The course to be offered in the following spring (下) semester); however, the courses in the fall and spring semesters are basically independent.

\*\* It is not required but desirable for students to master “Modern Physics” or other related courses.

\*\*\* The course is offered in English.

### **Course materials:**

Available on <http://lms.nthu.edu.tw>

### **References:**

“Concepts of Modern Physics”, sixth edition, by Arthur Beiser (Mc Graw Hill);

“Modern Quantum Mechanics”, by J.J. Sakurai (Addison-Wesley Publishing Company);

“Organic Electro-Optics and Photonics: Molecules, Polymers and Crystals” by L. R. Dalton (Cambridge Univ. Press); “Optics and Nonlinear Optics of Liquid Crystals”, by Iam-Choon Khoo (World Scientific);

“Nonlinear Optics”, by Robert W. Boyd (Academic Press) ···, etc.

*National Tsing Hua University*  
*10810 EE 599500 Special topics in materials science*  
*for organic optoelectronics*

**Teaching Method:**

Combination of blackboard teaching with power point viewgraphs.

Report presentation by students.

**Syllabus:**

Session 0: Introduction – Course guide –

Session 1—4:

- Quantized energy structures.
- From atoms to molecules (Computational chemistry).
- Quantization of molecular motion.

Session 5—6(7):

- Perturbation theory

Session (7)8—9:

- Symmetry of molecules

Session 9: Midterm

Session 10—11:

- Ligand field theory

Session 12—(13):

- Photo-physics of molecules

Session (13)—14:

- From single molecule to thin film

Session 14:

- Organic semiconductor
- Charge transport in organic thin film, ...etc.

Session 14—16: Molecular orientation and its related topics

- Characterization of thin films
- Molecular orientation and optoelectronic devices
- Probing techniques
- Related optics and physics

Session 17: Final

\*\*\*\* The contents and plans will be appropriately changed and adjusted during the course.

\*\*\*\*\* Exams may be replaced with report works.

**Grading:**

Midterm exam (30%), Final exam including a report and presentation (40%), Homework and class attendance and participation (30%)

\*\*\*\*\* This may be adjusted in the end of the semester.