Course syllabus

Basic Information:

Course title (中文): 有機光電材料科學

Course title (English): Materials Science for Organic Optoelectronics

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

Language for teaching: English

Class time: M5M6W5 *Location:* DELTA 台達 210

Course Description:

This course is constructively prepared for graduates as well as junior and senior undergraduate students. The course contents consist of materials science intrinsically required for understanding optoelectronic device technology. Before we explore the fundamentals of optoelectronic devices*, it is prerequisite to have fundamental knowledge on materials and their related areas, because 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 this course, we do not deal with organic device devices themselves.

* These matters will be provided 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.

** Having knowledge on "Modern Physics" or other related courses is not required but desirable.

*** This course is offered in English.

Course materials:

Available on eeclass https://eeclass.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.

Teaching Method:

Combination of blackboard teaching with power point viewgraphs.

Report presentation by students.

Syllabus:

Session 1 – 5: Introduction to chemical bonding theory

- ☐ From atoms to molecules (Computational chemistry)
- ☐ Valence bond theory
- ☐ Molecular orbital theory
- ☐ Quantization of molecular motions
- ☐ Energy structures

Session 6 – 7(8): Perturbation theory

- ☐ Time-independent
- ☐ Time dependent

Session 8 – 10: Symmetry of molecules

- ☐ Symmetry operations and elements
- ☐ Use of point group
- ☐ Group theory

Session 11 – 12(13): Metal complexes

- ☐ Crystal field theory
- ☐ Ligand field theory

Session (13)14 – 15: Photo-physics of molecules

- ☐ Light-matter interactions
- ☐ Photo-physical processes
- ☐ Born-Oppenheimer approximation

Session 16: From molecules to materials

- ☐ Molecule–molecule interactions
- ☐ Molecular orientation and its related topics …etc.

**** 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.