Nano-Photonics and Optoelectronics

1. **Lecture Hours: 32**
2. **Laboratory Hours: 0**
3. **Colloquia Hours: 0**
4. **Individual Study Hours: 32**
5. **Credits: 2.0**
6. **Occurrence**: **2nd year, 3rd year, 4th year; Summer**
7. **Prerequisite(s):**

   Physics A II, 100180121

   Quantum Theory and Statistical Physics in Optics*, 10041069

   Electrodynamics*, 100041001

   ***Recommended, not required as prerequisite**
8. **Course Description:**

   Nano-photonics and optoelectronics are interdisciplinary disciplines that study the interaction between photons and matter in nanostructures. Their research results can be applied to many fields such as information, energy, environment, biomedicine, etc., including the well-known photodetection, quantum communication, solar photovoltaics, etc. With the rapid development of nanotechnology in the past decade, new devices based on nanostructures have demonstrated unique and excellent performance, opening up a new path for the next generation high-performance devices. Our course is designed to lead students to explore the mysteries of nano-photonics and optoelectronics, discover new scientific phenomena, and guide students to discover their scientific interests in cutting-edge technology.

   Under the premise of ensuring basic teaching requirements, teachers can make appropriate adjustments and abridgements of content according to actual conditions.

   Key Words: nanophotonics; nano-optoelectronics; organic materials; III-V semiconductors; scientific skills.
9. **Course Outcomes:**

   After completing this course, a student should be able to:

   1) Understand the basic concepts of nanomaterials, nanophotonics, nano-optoelectronics and physics of semiconductor devices taught in this course.

   2) Learn about cutting-edge technologies developed in the recent decade of nanophotonics and nano-optoelectronics and their applications.

3) Learn about the scientific skills such as scientific paper reading and writing, as well as the preparation of resume and research proposal.

10. Course Content, Laboratories and Laboratory Hours

1.	**Fundamentals of semiconductor device physics**	4
2.	**Nano-optoelectronics**	4
3.	**III-V semiconductor nanostructure-based optoelectronic devices**	4
4.	**Synchrotron techniques for energy research**	2
5.	**Nanostructured material-based organic optoelectronics**	2
6.	**Tutorials**	2
7.	**Fundamentals of nanomaterials**	2
8.	**Up-conversion nanoparticle-based photonics**	2
9.	**Linear and nonlinear nano-photonics**	4
10.	**Scientific skills**	2
11.	**Tutorials**	2
12.	**Discussion on the future development directions of nanotechnologies**	2

11. Grading:

2 inclass quizzes: 40%

Inclass presentation: 20%

Final report: 40%

12. Text & Reference Book: S. M. Sze, Yiming Li and Kwok K. Ng, Physics of Semiconductor Devices, 4rd ed. [M]. New Jersey, John Wiley & Sons, Inc, 2021. ISBN: 978-1-119-42911-1.

P. Willmott, An Introduction to Synchrotron Radiation, Techniques and Applications, 1st ed. UK, John Wiley & Sons, 2011.

13. Course Lecturer： Ziyuan Li

Course Lecturer（Sign）：