

Course Title	Introduction to Electronics Materials Science
Registration Code	L100070001
Number of Credits	2
Years of Eligible Graduate Students	1-2
Semester	2nd
Period	Wed. 2nd
Room	B115 (Sugimoto Campus, OCU), A6-332 (OPU: Distant lecture)
Instructors	Masaaki Nakayama, Kim Tegi, and Naoteru Shigekawa
Office hours	Wed. 5th, Bldg. B, Room 510 in School of Engineering (Sugimoto Campus, OCU) nakayama@a-phys.eng.osaka-cu.ac.jp
Goals of the course	The basis of the physical properties and functions of semiconductors, which are the heart of electronics, are presented for graduate students with majors in informatics such as computer and system science and engineering. The aim of this lecture is for graduate students to understand the basis of electronics materials to develop the concept of the fusion of materials science and informatics.
Textbooks	
Books of reference	“Semiconductor Engineering” ed. by Toshio Fukami (Tokyo Denki University Press) in Japanese. Masaaki Nakayama, “Optical Properties of Semiconductors” (Corona publishing) in Japanese.
Allied subject	Introduction to System-inspired Material Science
Homework (Preparing for the classwork)	The students should study the subjects described in the Course Schedule in advance.
Course outline	In order to achieve the aim described above, this lecture consists of the following outlines. (1) Fundamental physical properties of semiconductors: crystal structures and band structures, density of states and carrier densities, impurity doping, and transport phenomena. (2) Optical properties of semiconductors: excitons, light absorption and reflection, and luminescence. (3) Semiconductor devices: p-n junctions, MOS structures, optical devices, logic devices, and power devices.
Class schedule	1st Introduction, Crystal structures and band structures (1) 2nd Crystal structures and band structures (2) 3rd Density of states and carrier densities 4th Impurity doping and Fermi level (p- and n-type semiconductors) 5th Transport phenomena (drift velocity and mobility) 6th Outline of excitons (electron-hole pairs) 7th Mechanism of light reflection and absorption (1) 8th Mechanism of light reflection and absorption (2) 9th Mechanism of luminescence 10th Outline of optical properties of nanostructure semiconductors 11th p-n junctions 12th Optical devices (LEDs, Laser diode, Solar cells) 13th MOS structures (Metal/Oxide/Semiconductor junctions) 14th Logic devices (CMOS logic) 15th Power devices (Power MOSFET, Power bipolar transistors)
Evaluation	Reports and attendance status