奈良先端大学院大学
シラバスシステム

Photonics Special B (4067)

■ Basic course information

Course type	Specialized Subjects	**Teacher training course**	Science
Number of Credits	1	**Required・Elective etc.**	Elective
Style	Lecture	**Main Language**	English
Scheduling	III	**Subject Registration System**	Use
Taking registration period	2018/10/02～2018/10/16	**Taking cancellation time limit**	2018/11/16

■ Registration Category

Education Programs	**IS**	**CB**	**BS**	**BN**	**MS**	**CP**	**DS**
Registration Category	△	△	△	○	○	○	○
Core Subjects	–	–	–	–	–	–	–
Registration requirements	・Take 12 or more credits from Basic Subjects and Specialized Subjects						

■ Overview

Supervising lecturer	Jun Ohta
Lecturer	Jun Ohta, Takayuki Yanagida, Takashi Tokuda, Noriaki Kawaguchi
Learning Objectives	In the formar four classes, principle, structure, function and applications of photosensors and image sensors are presented. The purpose of this part is to understand both basics and technical issues of the semiconductor photonic devices. In latter four classes, some fundamental physics and applications of indirect-type radiation detectors are explained. The purpose of these classes are to understand fundamental physics of luminescent phenomena, device technology of scintillators and dosimeter materials, and some applications including medical imaging, security system, oil-logging, high energy phyiscs and environmental monitoring.
Instructional Activities	For photonic / image sensors, from the concept of accumulation of photocarriers to advanced technologies for image sensors, device technology is described from both the aspects of semiconductor phisics and engineering. Since radiation detectors typically consist of phosphors and photodetectors, latter four courses require to understand semiconductor optical devices explained in former four classes. After the explanation about some fundamental physics of luminescent phenomena, scintillators and dosimeters, and their applications will be explained.

■ Course plan

Number	Date [Time]	Theme	Content
1	11/14 [1]	Basics of semiconductorengineering and opticalengineering	The basics of semiconductor engineering (e.g., bandstructures, optical transition, carrier density distribution,impurity doping, p-n junctions, carrier transport) for imagesensor are explained
2	11/16 [2]	Element devices of imagesensors andsemiconductor integratedcircuit processes	The lectures explain P-N junction diodes, photodiodes, MOScapacitors, and MOSFETs, as well as basic semiconductorintegrated circuit processes.
3	11/21 [1]	Pixel structures andbasic characteristics	The lectures explain (i) the concept of charge storage and 3T-APS/4T-APS, (ii) dark current, noise, and opticalcharacteristics (basic characteristics of image sensors), and(iii) comparison with visual systems in organisms.
4	11/22 [5]	Features of and outlookfor CMOS image sensors	The lecture explains the features of CMOS image sensors anda comparison with CCD sensors, and presents the latestresearch including pixel scaling and color processing
5	11/28 [1]	Physics of Luminescent materials	The lectures explain fundamental physics of absorption and emission. After the explanation of fundamental physics, measurement methodologies of absorption and luminescence phenomena are overviewed.
6	11/29 [3]	Scintillator	The lectures explain about fundamental physics of scintillation, and scintillation detectors.
7	11/30 [2]	Storage phosphors for dosimeter	The lectures explain mechanisms and fundamental physics of storage phosphors for dosimeters, actual device structure of dosimeters.
8	12/5 [4]	Radiation detectors	Scintillators and dosimeters are used in various fields, such as medical imaging, security inspection, well-logging, astro/particle physics, environmental monitoring and so on. The lectures explain about detectors and instrumentations for such applications.

■ Schedules

Number	Date	Time	Room	Note
1	11/14	1	F106	
2	11/16	2	F106	
3	11/21	1	F106	
4	11/22	5	F106	
5	11/28	1	F106	
6	11/29	3	F106	
7	11/30	2	F106	
8	12/5	4	F106	

■ Textbook/Reference book

Textbook	・None. Handout and slides will be provided as necessary.
Reference book	· "Basics and Applications of CCD/CMOS Image Sensors", Kazuya Yonemoto (CQ Publishing Co.,Ltd.) (in Japanese) · Jun Ohta "Smart CMOS Image Sensors and Applications" CRC Press .· Junichi Nakamura Ed., "Image Sensors and Signal Processing for Digital Still Cameras" CRCPress

■ Other information

Prerequisites	None
Office hour	Contact by email to decide dates
Grading	・Evaluated as S, A, B, C, or D ・Evaluated by examination, practice or report ・Evaluated by how the student understands the basic concepts and knowledges about semicondutor photosensor technology and indirect-type radiation detection technology.
Related subjects	None
Related Degree	Science
Notice	None

■ Lecture related URL

There is no data by which indication is possible.

■ Handouts

There is no data by which indication is possible.