Semiconductor Engineering 1

Basic Course Information

Course Number	01005098	**Subject Category**	Compulsory (M)
Class Format	Lecture	**Credit Type and Number of Credits**	1
Department	Mechatronics	**Student Category**	Year 5
Period of Study	Semester 1	**Classes per Week**	1
Required Materials	TBA		
Instructor	Hitoshi Nishizawa	Jirapat Anuntahirunrat	

Course Objective

The course provides students with introduction and basic knowledge of physics in Semiconductors and Semiconductor devices including pn-junction and pnp/npn-junctions.

Evaluation (Rubric)	Ideal Level of Achievement (Very Good)	Standard Level of Achievement (Good)	Unacceptable Level of Achievement (Fail)
Electrons' behavior in semiconductors	Able to explain electrons' behavior in semiconductors in detail.	Able to explain electrons' behavior in semiconductors.	Need help explaining how electrons behave in semiconductors.
Physics of PN junctions	Able to describe the characteristics of PN junctions using the band theory in detail.	Able to describe the characteristics of PN junctions using the band theory.	Cannot use the band theory to describe the characteristics of PN junctions.
Physics of bipolar transistors	Able to describe the characteristics of bipolar transistors using the band theory in detail.	Able to describe the characteristics of bipolar transistors using the band theory.	Cannot use the band theory to describe the characteristics of bipolar transistors.
Physics of LEDs and solar cells	Able to explain the characteristics of LEDs and solar cells using the band theory in detail.	Able to explain the characteristics of LEDs and solar cells using the band theory.	Cannot use the band theory to explain the characteristics of LEDs or solar cells.

Relationship with Learning Outcomes

M(2) Ability to design, propose and develop electrical and electronic systems for robotics/ mechatronic systems

Please change

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Teaching Method

Outline:	Lecture and group work
Class Format:	Lecture and group work
Please Note :	Students are required to ask any questions after sufficient self-learning

Course Plan

Semester 1	Contents and Method of Course	Goals	Related MOC
1st Week	History of semiconductor development (from vacuum tubes to semiconductors) *	Can explain the outline of semiconductor development history.	V-D 4
2nd Week	Solid state physics (electron volt, duality of electrons: waves and particles) *	Can explain the duality of electrons.	
3rd Week	Atomic structure and crystal structure of semiconductors *	Can explain the atomic and crystal structure of semiconductors.	V-C 3 54
4th Week	Electronic band structure and the behavior of electrons *	Can explain the electronic band structure of semiconductors.	V-C 3 55 V-C 3 56
5th Week	Carrier concentration in semiconductors and its effect on conductivity *	Can explain the effect of carrier concentration on conductivity.	V-C 3 56 V-C 3 58
6th Week	Carrier generation/recombination, diffusion current, and PN junction	Can explain how PN junction works.	V-C 3 59 V-C 3 60
7th Week	School event 5 *		
8th Week	Preparing for Mid-term examination *	Review problems for the mid-term examination.	
9th Week	Mid-term examination *	Can slove problems at the mid-term examination.	
10th Week	Mid-term examination week *		
11th Week	Return exam papers and feedback *	Review and summarize the learning.	
12th Week	Quantitative analysis of a PN junction, and reverse breakdown current *	Can explain the inner resitance and reverse current of a PN junction.	V-C 3 60
13th Week	National Holiday *		
14th Week	Metal-semiconductor contact and Schottky barrier *	Can explain the voltage-current characteristics at metal-semiconductor contacts.	
15th Week	Fundamental function of bipoler junction translstors	Can explain the electronic behavior of bipolar junction transistors using the band theory.	V-C 3 61
16th Week	Amplifier circuits using a bipolar junction translstor	Can explain the electronic behavior of bipolar junction transistors using the band theory.	V-C 3 61
17th Week	Dynamic characteristics of bipolar junction translstors	Can explain the switching phenomena of bipolar junction transistors.	
18th Week	Light emitting diodes (LED) and Solar cells *	Can estimate the collector current of bipolar junction transistors.	
19th Week	Preparing for final examination	Review related circuit problems for the final examination.	
20th Week	Final Examination *	Can slove problems at the final examination.	

Do not

	Examination	Quiz	Mutual Evaluations between students	Report	Portfolio	Other
Basic Ability	60	20		20		
Technical Ability						
Interdisciplinary Ability						