Akashi College	Year	2022	Course Title	Solid State Physics B

Course Information

Course Code	4421	Course Category	Specialized / Compulsory
Class Format	Lecture	Credits	Academic Credit: 2
Department	Electrical and Computer Engineering Electrical Engineering Course	Student Grade	4th
Term	Second Semester	Classes per Week	2
Textbook and/or Teaching Materials			
Instructor	OHMUKAI Masato		

Course Objectives

1) Learn about the Wiedemann–Franz law and Bloch's theorem.
2) Learn about dielectric polarization.
3) Learn about the various aspects of magnetic materials.

Rubric

	Ideal Level	Standard Level	Unacceptable Level
Achievement 1	Thoroughly understand the Wiedemann–Franz law and Bloch's theorem.	Understand the Wiedemann–Franz law and Bloch's theorem.	Do not understand the Wiedemann–Franz law and Bloch's theorem.
Achievement 2	Thoroughly understand dielectric polarization.	Understand dielectric polarization.	Do not understand dielectric polarization.
Achievement 3	Thoroughly understand the various aspects of magnetic materials.	Understand the various aspects of magnetic materials.	Do not understand the various aspects of magnetic materials.

Assigned Department Objectives

Teaching Method

Outline	The role of solids in electronic devices is very crucial. In classes, we will introduce the properties of dielectric and magnetic materials in addition to the nature of electrons in metals.
Style	The first part of classes will be taught in a lecture style to explain the outline. Then, each student will self-study. There will be a quiz at the end.
Notice	Because the class will handle various phenomena qualitatively, a mathematical foundation until the third year is essential. Also, be sure to review each time as new content will keep coming up. This course's content will amount to 90 hours of study in total. These hours include the learning time guaranteed in classes and the standard self-study time required for pre-study / review, and completing assignment reports. Student who fail to get a perfect score in quizzes will be given additional assignment reports. Students who miss 1/3 or more of classes will not be eligible for a passing grade.

Characteristics of Class / Division in Learning

☑ Active Learning	☐ Aided by ICT	☑ Applicable to Remote Class	☐ Instructor Professionally Experienced

Course Plan

			Theme	Goals
2nd Semester	3rd Quarter	1st	Wiedemann–Franz law	This law, which describes the relationship between electrical conduction and heat diffusion, can be derived from the basic principle.
		2nd	Bloch theorem, polarization and dielectric factors	Learn about the basis of electromagnetism by focusing on the Bloch function, which shows the electronic state of solids in crystals and understand the definition of polarization and dielectric factors.
		3rd	The Clausius–Mossotti equation	Can derive the Clausius–Mossotti equation, which is the equation of polarization and dielectric constant.
		4th	Electronic polarization	Can discuss on the electronic polarization quantitative.
		5th	Ion polarization	Can handle ion polarization quantitatively and learn about LST equations and residual lines.
		6th	Orientation polarization and the Langevin function	Can handle the orientation polarization quantitatively and understand the characteristics of the Langevan function which is used in orientation polarization.
		7th	Complex permittivity and dielectric loss	Understand the concept of complex permittivity, and the fact that imaginary components are deeply involved in dielectric loss.
		8th	Midterm test	Score 60 or more marks.
	4th Quarter	9th	Classification of magnetization and magnetic material	Review the relationship between magnetization, magnetic field and magnetic flux density, and learn about the characteristics of the five types of magnetic materials.
		10th	Factors of magnetism	Learn about the angular momentum caused by orbital motion and the angular momentum caused by spin, which are the factors of magnetism, and learn about the the Bohr magneton and the Landé g-factor.

		11th	Five types of magnetic materials, magnetic anisotropy and structure of magnetic domain	Can classify five types of magnetic materials, learn about magnetic anisotropy and structure of magnetic domain, and understand the causes of hysteresis properties in the magnetization curve.
		12th	The temperature characteristics of magnetic susceptibility	Can derive the Curie law in paramagnetic and Curie Weiss in ferromagnetic.
		13th	Application of magnetic materials	Learn about the characteristics of iron-core and permanent magnet materials.
		14th	History of magnetic materials research and topics on magnetic materials	Learn about the history of the development of magnetic materials in Japan, and learn about the applications of different magnetic materials.
		15th	Review	Review the content so far.
		16th	Final exam	Score 60 or more marks.

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	100	0	0	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	100	0	0	0	0	0	100
Cross Area Proficiency	0	0	0	0	0	0	0