

Anan College				Course of Chemical Engineering								Year				2024											
Department Goals																											
Course Category		Course Title	Course Code	Credit Type	Credits	Class Hours per Week																Instructor	Division in Learning				
						1st Year				2nd Year				3rd Year				4th Year						5th Year			
						1st		2nd		1st		2nd		1st		2nd		1st		2nd				1st		2nd	
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q			1Q	2Q	3Q	4Q
Specialized	Common	Fundamental Organic Chemistry	1412A10	School Credit	1																	Sugiya ma Yuuki					
Specialized	Common	Fundamental Inorganic Chemistry	1412B10	School Credit	1																	Zheng Tao					
Specialized	Common	Fundamental Chemical Engineering	1412E01	School Credit	1																	Ezure Ryosuke					
Specialized	Common	Fundamental Biology	1412F03	School Credit	1																	Ota Naotomo					
Specialized	Common	Fundamental Experiments in Materials Chemistry 1	1412T11	School Credit	2																	Sugiya ma Yuuki, Zheng Tao					
Specialized	Common	Fundamental Experiments in Materials Chemistry 2	1412T21	School Credit	2																	Sugiya ma Yuuki, Otani Takashi					
Specialized	Common	Fundamental Physics 1	1413301	School Credit	2																	Nakamura Atsunobu					
Specialized	Common	Advanced Chemistry Seminar	1413902	School Credit	1																	Nakamura Atsunobu,Konishi Tomoya,Ota Naotomo,Otani Takashi,Zheng Tao,Ueda Kohei, Sugiya ma Yuuki, Ezure Ryosuke					
Specialized	Common	Organic Chemistry 1	1413A01	School Credit	2																	Sugiya ma Yuuki, Otani Takashi					
Specialized	Common	Inorganic Chemistry 1	1413B01	School Credit	2																	Zheng Tao					
Specialized	Common	Analytical Chemistry	1413C01	School Credit	2																	Ueda Kohei, Ezure Ryosuke					

Specialized	Common	Physical Chemistry 1	1413D04	School Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											2	2								Konishi Tomoya	
										2	2																
Specialized	Common	Chemical Engineering 1	1413E03	School Credit	1	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>												2								Ueda Kohei	
											2																
Specialized	Common	Biology	1413G01	School Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td>2</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											2	2								Ota Naoto mo,Otani Takashi	
										2	2																
Specialized	Common	Experiments in Materials Chemistry and Exercises 1	1413T05	School Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>											4									Ueda Kohei, Konishi Tomoya,Nakamura Atsunobu,Zheng Tao,Ezure Ryosuke	
										4																	
Specialized	Common	Experiments in Materials Chemistry and Exercises 2	1413T06	School Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr></table>												4								Ezure Ryosuke,Zheng Tao,Ueda Kohei, Ota Naoto mo,Otani Takashi	
											4																
Specialized	Common	Fundamental Physics 2	1414301	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Yoshida Takehito	
														2													
Specialized	Common	Organic Chemistry 2	1414A10	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr></table>														2						Sugiya Yuuki	
													2														
Specialized	Common	Advanced Organic Chemistry	1414A11	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Sugiya Yuuki	
														2													
Specialized	Common	Inorganic Chemistry 2	1414B10	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr></table>														2						Zheng Tao	
													2														
Specialized	Common	Advanced Inorganic Chemistry	1414B11	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Zheng Tao	
														2													
Specialized	Common	Physical Chemistry 2	1414D04	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr></table>														2						Yoshida Takehito	
													2														
Specialized	Common	Physical Chemistry 3	1414D11	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Nakamura Atsunobu	
														2													
Specialized	Common	Biochemistry 2	1414G02	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Otani Takashi	
														2													
Specialized	Common	Biochemistry1	1414G03	Academic Credit	2	<table><tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr></table>															2					Otani Takashi	
														2													

Specialized	Compulsory	Experiments in Advanced Chemistry Laboratory	1414T07	Academic Credit	2															Nakamura Atsunobu,Ota Naotomo,Konishi Tomoya,Zheng Tao,Otani Takashi,Ueda Kohei,Ezure Ryosuke,Sugiyama Yuuki	
Specialized	Compulsory	Chemical Engineering 2	1414T09	Academic Credit	2											2				Ezure Ryosuke	
Specialized	Compulsory	Experiments and Exercises in Materials Chemistry 3	1414T12	Academic Credit	2											4				Nakamura Atsunobu,Konishi Tomoya,Ota Naotomo,Otani Takashi,Zheng Tao,Ueda Kohei,Sugiyama Yuuki,Ezure Ryosuke	
Specialized	Elective	Information Processing	1494O01	Academic Credit	2											2				Nakamura Atsunobu	
Specialized	Elective	Instrumental Analysis	1494C01	Academic Credit	2											2				Nakamura Atsunobu,Konishi Tomoya,Ota Naotomo,Otani Takashi,Zheng Tao,Ueda Kohei,Sugiyama Yuuki,Ezure Ryosuke,Yoshida Takehiro	
Specialized	Elective	Environmental Engineering	1494F03	Academic Credit	2											2				Ota Naotomo	
Specialized	Elective	Internship	1494R11	School Credit	1											2	2			Ueda Kohei	

Specialized	Compulsory	Probability and Statistics	1514A01	Academic Credit	2		Sugino Ryuzaburo	
Specialized	Elective	Minor	1554200	Academic Credit	2		Ueda Kohei	
Specialized	Compulsory	Research for Graduation Thesis	1415000	School Credit	10		Nakamura Atsunobu,Yoshida Takehiro,Ota Naotomo,Zheng Tao,Otani Takashi,Sugi yama Yuuki,Konishi Tomoya,Ueda Kohei,Ezure Ryo suke	
Specialized	Compulsory	Biotechnology	1415H01	Academic Credit	2		Ota Naotomo	
Specialized	Elective	Materials Engineering	1495202	Academic Credit	2		Konishi Tomoya	
Specialized	Elective	Engineering for Semiconductors	1495802	Academic Credit	2		Nakamura Atsunobu	
Specialized	Elective	QuantumChemistry2	1495806	Academic Credit	2		Yoshida Takehi to	
Specialized	Elective	QuantumChemistry3	1495807	Academic Credit	2		Yoshida Takehi to	
Specialized	Elective	Polymer Chemistry	1495A01	Academic Credit	2		Otani Takas hi	

Anan College		Year	2024	Course Title	Fundamental Organic Chemistry
Course Information					
Course Code	1412A10		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 1	
Department	Course of Chemical Engineering		Student Grade	2nd	
Term	Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials	Chemistry (Daiichi Gakushu-sha)				
Instructor	Sugiyama Yuuki				
Course Objectives					
1. The students will learn the characteristics of organic compounds in general and master classification methods and types of functional groups. 2. The students will learn the nomenclature of aliphatic hydrocarbons, the properties of individual substances, and the concept of organic compounds based on molecular structures such as single, double, and triple bonds. 3. The students will learn the characteristic properties of alcohols, ethers, aldehydes, ketones, carboxylic acids, esters, etc., as representatives of organic compounds containing oxygen. 4. The students will learn that aromatic compounds are a unique group of atoms and will learn about significant reactions such as nitration, sulfonation, and halogenation and the properties of typical compounds formed by these reactions. 5. The students will learn the characteristics of polymers in general and master classification methods and the properties of typical polymers.					
Rubric					
	Ideal Level		Standard Level		Minimum Level
Objective 1	Explain all organic compounds and polymer's nomenclature within a chemistry textbook.		Explain about 70% of organic compounds and polymer's nomenclature within a chemistry textbook.		Explain about 50% of organic compounds and polymer's nomenclature within a chemistry textbook.
Objective 2	Explain all structures related to organic compounds and polymers within a chemistry textbook.		Explain about 70% of structures related to organic compounds and polymers within a chemistry textbook.		Explain about 50% of structures related to organic compounds and polymers within a chemistry textbook.
Objective 3	Explain all characteristics related to organic compounds and polymers within a chemistry textbook.		Explain about 70% of characteristics related to organic compounds and polymers within a chemistry textbook.		Explain about 50% of characteristics related to organic compounds and polymers within a chemistry textbook.
Objective 4	Explain all reactions related to organic compounds and polymers within a chemistry textbook.		Explain about 70% of reactions related to organic compounds and polymers within a chemistry textbook.		Explain about 50% of reactions related to organic compounds and polymers within a chemistry textbook.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	The specialized field of the university course, which starts in the third year, is based on chemistry in high school. This course is a bridging course for organic chemistry in the university course, including organic chemistry in high school. It is designed to provide students with a solid foundation in chemistry in the second year, with an awareness that it is the "basis" for those studying chemistry.				
Style	The class will follow the order of the lesson plan for the most part. In addition, students will be required to submit several reports on theirs.				
Notice					
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class	
				<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
2nd Semester	3rd Quarter	1st	Alcohols and ethers	Explain the types, nomenclature, and properties of alcohols and ethers.	
		2nd	Aldehydes and ketones	Explain the types, nomenclature, and properties of aldehydes and ketones.	
		3rd	Carboxylic acids and esters	Explain the types and nomenclature of carboxylic acids and esters, their properties, and enantiomer.	
		4th	Aromatic compounds	Explain the types and nomenclature of aromatic compounds nomenclature, properties, and reactions specific to aromatics.	
		5th	Phenols	Explain the types, nomenclature, and properties of phenols.	
		6th	Aromatic carboxylic acids, aromatic amines	Explain aromatic carboxylic acids and aromatic amines' types, nomenclature, and properties.	
		7th	Separation of organic compounds	Explain that it can separate organic compounds by using the properties of their functional groups.	
		8th	Mid-term examination		
	4th Quarter	9th	Oils (triacylglycerol)	Explain oils (triacylglycerol).	

		10th	Polymers and their classification	Understand the characteristics of polymers and explain their classification methods.
		11th	Synthetic fibers	Explain the characteristics, types, and synthesis methods of synthetic fibers.
		12th	Synthetic resin	Explain the characteristics, types, and synthesis methods of synthetic resin.
		13th	Rubber	Explain the characteristics, types, and synthesis methods of rubber.
		14th	Functional polymers	Explain functional polymers.
		15th	Treatment of polymer compounds	Explain the treatment and recycling of polymers.
		16th	Return and explanation of final examination	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	70	0	0	0	30	100
Basic Proficiency	60	0	0	0	20	80
Specialized Proficiency	10	0	0	0	10	20
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Fundamental Inorganic Chemistry
Course Information					
Course Code	1412B10		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 1	
Department	Course of Chemical Engineering		Student Grade	2nd	
Term	Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials	High School Advanced Chemistry (Daiichi Gakushusha Corporation)				
Instructor	Zheng Tao				
Course Objectives					
1. To master the types of crystal structures and the characteristics of their properties. To master the arrangement of constituent particles in crystals. 2. To master the properties of various solutions. To learn how substances dissolve in solvents and their solubility 3. To master classification of elements and their properties. 4. To acquire the characteristics of each group of elements and the properties of their compounds.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Be able to explain all chemical bonds and how the constituent particles are arranged in a crystal, and be able to perform all calculations related to the density of the gas crystal lattice, etc. The following is a list of the most common types of crystals that can be used in the program.		The student should be able to explain how chemical bonds and constituent particles are arranged in a crystal, and be able to perform 70% of calculations related to the density of the gas crystal lattice, etc.		Unable to explain chemical bonding and how the constituent particles are arranged in a crystal. Cannot perform calculations related to the density of the gas crystal lattice, etc.
Achievement 2	Be able to explain all the mechanisms of dissolution and properties of solutions, and be able to perform all calculations related to the concentration of solutions, etc.		The student is able to explain the mechanism of dissolution and the properties of solutions, and is able to perform 70% of the calculations related to the concentration of solutions, etc.		Cannot explain the mechanism of dissolution and properties of solutions. Cannot perform calculations related to the concentration of solutions, etc.
Achievement 3	Understand the correlation between the position and properties of each element in the periodic table and the significance of each element and compound in industrial applications.		70% understanding of the correlation between the position of each element in the periodic table and its properties and the significance of each element in industrial applications.		Failure to understand the position and properties of each element in the periodic table and the significance of each element in industrial applications.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	The specialized fields of university courses starting in the third year are based on chemistry in high school. This lecture is positioned as a bridging subject to the university course including high school courses, and students will acquire a solid foundation of chemistry in the second year, being aware that it is the "basis" and "foundation" for those who study chemistry.				
Style	The class will be conducted almost according to the order of the lesson plan. In order to deepen understanding, students will be required to submit reports on exercises and take quizzes several times during the class period.				
Notice					
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class	
				<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
2nd Semester	3rd Quarter	1st	Chemical Bonding and Crystal Types	Describe the types and characteristics of crystals.	
		2nd	Structure of metal crystals	To be able to calculate the characteristics and density of lattices such as face-centered cubic lattice.	
		3rd	Structure of ionic and covalent crystals	Explain the structure of ionic crystals and covalent crystals.	
		4th	Dissolution and solution	Understand how substances dissolve in solvents, and be able to calculate solubility of solids and crystalline water.	
		5th	Concentration of solution	to be able to calculate concentrations of various solutions.	
		6th	Classification and Properties of Elements	Explain the correlation between the position of each element on the periodic table and its properties.	
		7th	Hydrogen, Group 18, and Group 17 Elements	To be able to explain the properties and uses of hydrogen, Group 18, and Group 17 elements alone and in compounds.	
		8th	Second semester mid-term examination		

	4th Quarter	9th	Group 16, 15, and 14 elements	To be able to explain the properties and uses of group 16, 15, and 14 elements and their compounds.
		10th	Inorganic Chemical Industry	To be able to explain industrial manufacturing processes of sulfuric acid, ammonia, and nitric acid.
		11th	Group 1 and 2 elements	To be able to explain the properties and uses of group 1 and 2 elements and their compounds.
		12th	Typical elements showing amphoteric properties	To be able to explain the properties and uses of individual elements and compounds of typical elements showing amphoteric properties.
		13th	Transition elements (1)	Explain the characteristics and applications of Fe and Cu elements.
		14th	Transition elements (2)	To explain the characteristics and applications of Ag, Zn, Cr, and Ti
		15th	Summary of elements	
		16th	Final Examination Return of Answers	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	0	30	100
Basic Proficiency	60	0	0	0	0	20	80
Specialized Proficiency	10	0	0	0	0	10	20
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Fundamental Chemical Engineering
Course Information						
Course Code	1412E01		Course Category	Specialized / Compulsory		
Class Format	Lecture		Credits	School Credit: 1		
Department	Course of Chemical Engineering		Student Grade	2nd		
Term	First Semester		Classes per Week	前期:2		
Textbook and/or Teaching Materials	ベーシック化学工学（化学同人）橋本健治著					
Instructor	Ezure Ryosuke					
Course Objectives						
1. Understand quantities and units in chemical engineering. 2. Understand and apply material and energy balance in processes.						
Rubric						
	Ideal Level		Standard Level		Minimum Level	
Achievement 1	Understand quantities and units in chemical engineering. Calculate to convert between units.		Understand quantities and units in chemical engineering. Calculate to convert between commonly used units.		Understand quantities and units in chemical engineering.	
Achievement 2	Understand and apply material balance to processes with and without chemical reactions.		Understand and apply material balance to processes.		Understand material balance.	
Achievement 3	Understand and apply energy balance in processes with and without chemical reactions.		Understand and apply energy balance to processes.		Understand energy balance.	
Assigned Department Objectives						
学習・教育到達度目標 D-1						
Teaching Method						
Outline	Chemical engineering is a field of engineering that deals with the operation and design of chemical plants. This course introduces (1) quantity and units and (2) material and energy balance, as important concepts in chemical engineering.					
Style	Assignments will be given for each lecture. The assignments will help you review and prepare for the lecture. Some quizzes will be given during the class. Please remember to bring your calculator.					
Notice	Repeat the examples until you can solve them correctly and ensure your understanding. Be sure to master the mindset of applying principles to solve problems rather than memorizing answers. If you have any questions, please ask them in class. Attitude is also a factor in scoring. No questions will be accepted during the exam period.					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester	1st Quarter	1st	What is chemical engineering?	Explain how the chemical industry works.		
		2nd	Quantities and units	Explain quantities and units in chemical engineering.		
		3rd	SI units, Unit Conversion	Explain SI units.		
		4th	Material balance	Explain the classification of chemical equipment and processes.		
		5th	Material balance equation	Explain the concept of material balance and how it is calculated.		
		6th	Material balance for physical processes 1	Apply material balance to physical processes such as evaporation and concentration.		
		7th	Material balance for physical processes 2	Apply material balance to complex physical processes.		
		8th	Material balances with chemical reactions 1	Apply material balance to processes with chemical reactions.		
	2nd Quarter	9th	Midterm exam			
		10th	Material balances with chemical reactions 2	Apply material balance to processes with chemical reactions.		
		11th	Energy balance of physical processes 1	Explain enthalpy changes in physical processes.		
		12th	Energy balance of physical processes 2	Calculate enthalpy changes in physical processes.		
		13th	Heat of reaction, Hess' law	Explain the heat of reaction. Calculate the heat of reaction using Hess's law.		
		14th	Energy balances with chemical reactions	Calculate enthalpy changes in processes involving chemical reactions.		
		15th	Review	Review		
		16th	Final exam			
Evaluation Method and Weight (%)						
	Examination		Quiz	Portfolio	Other	Total

Subtotal	70	0	25	5	100
Basic Proficiency	30	0	10	5	45
Specialized Proficiency	20	0	10	0	30
Cross Area Proficiency	20	0	5	0	25

Anan College		Year	2024		Course Title	Fundamental Biology
Course Information						
Course Code		1412F03		Course Category	Specialized / Compulsory	
Class Format		Lecture		Credits	School Credit: 1	
Department		Course of Chemical Engineering		Student Grade	2nd	
Term		Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials		seibutskiso, tokyoshoseki				
Instructor		Ota Naotomo				
Course Objectives						
1. To be able to explain the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information. 2. To be able to explain the mechanism to maintain homeostasis of living organisms.						
Rubric						
		Ideal Level		Standard Level		Unacceptable Level
Achievement 1		To be able to explain in detail about the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information.		To be able to explain the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information.		To be able to understand the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information.
Achievement 2		To be able to explain in detail about the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information.		To be able to explain the mechanism to maintain homeostasis of living organisms.		To be able to understand the common characteristics of living organisms: cells, energy and metabolism, and expression of genetic information.
Assigned Department Objectives						
学習・教育到達度目標 A-3 学習・教育到達度目標 D-1						
Teaching Method						
Outline		The objective of this course is to acquire basic knowledge of the structure and function of organisms. The content is "Basic Biology" of high school.				
Style		Students will be evaluated by quizzes to confirm their preparation, assignments, and periodic examinations				
Notice						
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme		Goals	
2nd Semester r	3rd Quarter	1st	Diversity and commonality of organisms		To be able to explain the difference between prokaryotes and eukaryotes, and the structure and function of the nucleus, mitochondria, chloroplast, plasma membrane, cell wall, and vacuole. To be able to explain the theory of intracellular symbiosis.	
		2nd	Organisms and energy		To be able to explain metabolism, catabolism, anabolism and the role of ATP. To be able to explain what enzymes are and the role of enzymes in metabolism.	
		3rd	Photosynthesis and respiration		To be able to explain the general processes of photosynthesis and respiration.	
		4th	Genetic information and DNA		To be able to explain the structure of DNA and genetic information.	
		5th	Genetic information and DNA		To be able to explain the structure of DNA and genetic information.	
		6th	Genetic information and protein		To be able to explain the relationship between genetic information and proteins, structure of chromosomes and distribution of genetic information	
		7th	Genetic information and protein		To be able to explain the relationship between genetic information and proteins, structure of chromosomes and distribution of genetic information	
		8th	Mid-term Examination			
	4th Quarter	9th	Internal environment and signal transduction		To be able to explain the body environment.	
		10th	Internal environment and signal transduction		To be able to explain information transmission by the nervous system	
		11th	Internal environment and signal transduction		To be able to explain signal transduction by hormones	
		12th	Internal environment and signal transduction		To be able to explain the regulation of blood glucose concentration	
		13th	Function of immunity		To be able to explain the mechanism of immunity	

		14th	Function of immunity		To be able to explain immune memory		
		15th	Function of immunity		To be able to explain the relationship between immunity and various diseases		
		16th	Final examination				
Evaluation Method and Weight (%)							
	Examination	Presentation	Mutual Evaluations between students	Attitude	Quiz	Other	Total
Subtotal	40	0	0	30	30	0	100
Basic Proficiency	40	0	0	30	30	0	100
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Fundamental Experiments in Materials Chemistry 1	
Course Information							
Course Code		1412T11		Course Category		Specialized / Compulsory	
Class Format		Experiment / Practical training		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		2nd	
Term		First Semester		Classes per Week		前期:4	
Textbook and/or Teaching Materials		Handout (Fundamental Experiments in Materials Chemistry 1), Fundamentals of Chemistry (Daiichi Gakushu-sha), Chemistry (Daiichi Gakushu-sha)					
Instructor		Sugiyama Yuuki,Zheng Tao					
Course Objectives							
1. The students will observe chemical reactions and logically consider the phenomena. 2. The students will learn how to prepare reports using experimental data. 3. The students will learn qualitative analysis of cations. 4. The students will learn quantitative analysis (neutralization titration, redox titration, chelatometric titration).							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Objective 1		The student will logically and appropriately consider chemical reactions.		The student will logically consider chemical reactions.		The student will consider chemical reactions.	
Objective 2		The student will prepare a logical and appropriate report using the experimental data.		The student will prepare a logical report using the experimental data.		The student will prepare a report using the experimental data.	
Objective 3		The students will understand each reaction of cations and be able to carry out experiments for systematic qualitative analysis smoothly.		The students will carry out experiments for systematic qualitative analysis smoothly.		The students will carry out experiments for systematic qualitative analysis.	
Objective 4		The students will understand the similarities and differences between neutralization titration, redox titration, and chelatometry in quantitative analysis and be able to proceed smoothly with the experiments.		The students will use neutralization titration, redox titration, and chelatometry in quantitative analysis and be able to proceed smoothly with the experiments.		The students will use neutralization titration, redox titration, and chelatometry in quantitative analysis and be able to proceed with the experiments.	
Assigned Department Objectives							
学習・教育到達度目標 D-2 学習・教育到達度目標 D-4							
Teaching Method							
Outline		To understand and master chemistry as an academic discipline, it is essential to take classes in each specialized subject and conduct experiments in chemistry. This course is the first experimental course for students after they are assigned to the Chemistry Course. It aims to provide basic knowledge of chemistry experiments (experimental techniques, rules of chemistry laboratories, how to prepare laboratory notebooks, how to discuss experimental results, etc.). This course focuses on analysis, the foundation of chemistry experiments, and aims to provide students with knowledge and skills in fundamental qualitative and quantitative analysis.					
Style		Experiments are the foundation of chemistry, and mastery of basic techniques is essential. Students will first consider the purpose of the experiment, learn experimental methods and concepts in the preliminary study, and then confirm them in the experiment to experience and deepen their understanding of the laws of chemistry. After the experiments, students analyze the experimental data obtained through accurate measurements and compile them into a report. If this report writing phase is considered a review, the students will learn the experiment in depth by repeating the chemistry experiment's preparation, experiment, and review phases. Students must complete the experimental plan in the experimental notebook before the experiment begins. At the end of the experiment, students must submit the notebook and report the results and experimental data to the instructor in charge to complete this experiment.					
Notice		The following precautions must be taken to ensure the experiment is carried out safely. 1. Eating and drinking are strictly prohibited in the laboratory. 2. Students must wear the prescribed white lab coat and jacket when entering the laboratory. Students with long hair must tie it back. 3. Before starting experiments, students must wear safety glasses and gloves. 4. Students must promptly follow any instructions given by the teacher. 5. Reports must be submitted by the due date. 6. In case of absence, notify the teacher immediately. No credit will be given for any unexperienced work or reports that have yet to be submitted. 7. Grades will be based on reports, notes, examinations, and attitude.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Guidance				
		2nd	Writing notes and reports for student experiments		Write notes and reports.		
		3rd	Laboratory rules, basic procedures		Understand basic procedures and prepare reagents.		
		4th	Qualitative Analysis 1		Separate and confirm cations (genus I).		
		5th	Qualitative Analysis 2		Separate and confirm cations (genus III).		

		6th	Qualitative Analysis 3	Separate and confirm cations (genus V).
		7th	Qualitative analysis of cations (unknown sample analysis)	Analyze unknown samples for cations.
		8th	Quantitative analysis	Explain the basics of quantitative analysis and write neutralization and redox reaction equations.
	2nd Quarter	9th	Neutralization titration 1	Carry out neutralization titrations and calculate the concentrations of acids and bases.
		10th	Neutralization titration 2	Carry out neutralization titration and calculate concentrations of acids and bases.
		11th	Redox titration	Carry out redox titration and calculate concentrations of oxidants or reductants.
		12th	Chelatometric titration	Carry out chelatometry and calculate the concentration and hardness of complexes.
		13th	Buffer solution	Learn the principles of buffer solutions and can calculate the pH of buffer solutions.
		14th	Water quality examine	Carry out the properties of water and analyze COD, an organic pollution indicator of water quality.
		15th	Instrument Check, examination, submission of notes, and summary of experiments	
		16th	Preliminary Experiment Day/Instrument Check	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	0	0	0	0	100	100
Basic Proficiency	0	0	0	0	60	60
Specialized Proficiency	0	0	0	0	40	40
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Fundamental Experiments in Materials Chemistry 2	
Course Information							
Course Code		1412T21		Course Category		Specialized / Compulsory	
Class Format		Experiment / Practical training		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		2nd	
Term		Second Semester		Classes per Week		後期:4	
Textbook and/or Teaching Materials		Handout (Fundamental Experiments in Materials Chemistry 1), Fundamentals of Chemistry (Daiichi Gakushu-sha), Chemistry (Daiichi Gakushu-sha)					
Instructor		Sugiyama Yuuki,Otani Takashi					
Course Objectives							
1. The students will learn how to prepare reports using experimental data. 2. The students will use experimental methods to synthesize organic compounds (assembly of experimental apparatus, weighing and mixing of reagents, adjustment of reaction conditions, post-reaction treatment, isolation and purification of products). 3. The students will use methods to confirm (identify) products of organic compounds.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Objective 1		The student will prepare a logical and appropriate report using the experimental data.		The student will prepare a logical report using the experimental data.		The student will prepare a report using the experimental data.	
Objective 2		The student will properly perform synthetic experiments on organic compounds.		The student will perform synthetic experiments on organic compounds.		The student will conduct synthetic experiments of organic compounds with instructions.	
Objective 3		The students will adequately identify the products of organic compounds.		The students will identify the products of organic compounds.		The students identify the products of organic compounds with instructions.	
Assigned Department Objectives							
学習・教育到達度目標 D-2 学習・教育到達度目標 D-4							
Teaching Method							
Outline		To understand and master chemistry as an academic discipline, it is essential to take classes in each specialized subject and conduct experiments in chemistry. This course is the first experimental course for students after they are assigned to the Chemistry Course. It aims to provide basic knowledge of chemistry experiments (experimental techniques, rules of chemistry laboratories, how to prepare laboratory notebooks, how to discuss experimental results, etc.). To learn basic organic chemistry experimental operations (assembly of experimental apparatus, weighing and mixing of reagents, adjustment of reaction conditions, post-treatment of reactions, isolation, and purification of products) and methods to check products by performing typical organic chemistry reactions. Understand the meaning of experimental manipulations and reaction mechanisms, and be able to prepare logical reports of experimental results.					
Style		Experiments are the foundation of chemistry, and mastery of basic techniques is essential. Students will first consider the purpose of the experiment, learn experimental methods and concepts in the preliminary study, and then confirm them in the experiment to experience and deepen their understanding of the laws of chemistry. After the experiments, students analyze the experimental data obtained through accurate measurements and compile them into a report. If this report writing phase is considered a review, the students will learn the experiment in depth by repeating the chemistry experiment's preparation, experiment, and review phases. Students must complete the experimental plan in the experimental notebook before the experiment begins. At the end of the experiment, students must submit the notebook and report the results and experimental data to the instructor in charge to complete this experiment.					
Notice		The following precautions must be taken to ensure the experiment is carried out safely. 1. Eating and drinking are strictly prohibited in the laboratory. 2. Students must wear the prescribed white lab coat and jacket when entering the laboratory. Students with long hair must tie it back. 3. Before starting experiments, students must wear safety glasses and gloves. 4. Students must promptly follow any instructions given by the teacher. 5. Reports must be submitted by the due date. 6. In case of absence, notify the teacher immediately. No credit will be given for any unexperienced work or reports that have yet to be submitted. 7. Grades will be based on reports, notes, examinations, and attitude.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester r	3rd Quarter	1st	Guidance				
		2nd	Separation and purification of organic compounds (1)		Purify by recrystallization		
		3rd	Synthesis of superabsorbent polymer (1)		Synthesize cross-linkable polymer.		
		4th	Synthesis of superabsorbent polymer (2)		Evaluate the water absorption of synthesized polymers.		
		5th	Synthesis of ethyl acetate (1)		Synthesize ester.		
		6th	Synthesis of ethyl acetate (2)		Perform fractional distillation, GC, and NMR measurements to identify ethyl acetate.		
		7th	IR, NMR analysis method		Explain and analyze the principles of IR and NMR.		

		8th	Separation and purification of organic compounds (2)	Extraction is performed using a separatory funnel.
	4th Quarter	9th	Synthesis of acetanilide (1)	Synthesize amide.
		10th	Synthesis of acetanilide (2)	IR, NMR, and melting point measurements are performed to identify acetanilide.
		11th	Report coaching and lectures	
		12th	Interfacial polycondensation reaction	Synthesize 66 nylon.
		13th	Synthesis of azo dyes (1)	Synthesize azo compound by azo coupling.
		14th	Synthesis of azo dyes (2)	Identify compounds by TLC.
		15th	Instrument Check, examination, submission of notes, and summary of experiments	
		16th	Preliminary Experiment Day/Instrument Check	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	0	0	0	0	100	100
Basic Proficiency	0	0	0	0	60	60
Specialized Proficiency	0	0	0	0	40	40
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Fundamental Physics 1	
Course Information							
Course Code		1413301		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		3rd	
Term		Year-round		Classes per Week		前期:2 後期:2	
Textbook and/or Teaching Materials		Syohokaramanabukisobuturigaku (Rikigaku I) , Rikigaku I Mondaisyu (Dainihontosyo)					
Instructor		Nakamura Atsunobu					
Course Objectives							
1. Able to formulate and solve equations of motion for problems. 2. Able to solve the problem using the conservation laws of energy, momentum, etc. 3. Able to solve rotational motion and simple harmonic motion problems.							
Rubric							
		Ideal Level		Standard Level		Unacceptable Level	
Achievement 1		Able to solve the motion of objects using your knowledge of calculus.		Able to solve the motion of objects for systems with internal and external forces using formulae.		Able to solve the motion of objects for a simple system with only internal forces.	
Achievement 2		Able to formulate equations that express conservation laws and solve the problem, understanding the meaning of conservation laws.		Able to formulate equations that express conservation laws and solve the problem.		Able to formulate equations that express conservation laws for a simple system, and solve the problem.	
Achievement 3		Able to formulate equations and solve the problem, with the equations of motion and conservation laws in mind.		Able to formulate equations according to the procedure, and solve the problem.		Able to solve the problem by substituting in the formulae.	
Assigned Department Objectives							
学習・教育到達度目標 B-3							
Teaching Method							
Outline		Mechanics is the basis for studying quantum chemistry. In order to learn it, knowledge of mathematics such as vectors, differentiation, and integration is required. In this course, first, we review these. After that, we proceed to study the laws of motion, conservation laws, circular motion, and simple harmonic oscillation.					
Style		We review mathematics until the midterm exams. After learning the contents of each lesson, we practice. After the midterm exams, we study the mechanics content. Explanations are given using textbooks according to the lesson plan. Do frequent quizzes.					
Notice		In addition to the textbooks specified for this course, study using the mathematics and physics textbooks you have used so far. Quizzes are given frequently, so be sure to prepare for and review what you have learned.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester r	1st Quarter	1st	Vector calculations		Able to calculate sums, differences, and inner products of vectors.		
		2nd	Calculations on exponential and logarithmic functions.		Able to calculate exponential and logarithmic functions.		
		3rd	Calculation of derivatives 1		Able to differentiate integer expressions, products and quotients of functions.		
		4th	Calculation of derivatives 2		Able to differentiate exponential and logarithmic functions, and composite functions.		
		5th	Calculation of integrals 1		Able to integrate integer expressions, products and quotients of functions.		
		6th	Calculation of integrals 2		Able to calculate substitution integrals and partial integrals.		
		7th	Maximum and minimum of functions		Able to calculate the maximum and minimum of functions.		
		8th	Midterm exam				
	2nd Quarter	9th	Velocity and acceleration		Able to calculate velocity and acceleration.		
		10th	Velocity-addition formula and relative velocity		Able to calculate velocity-addition and relative velocity.		
		11th	Motion in a gravitational field		Able to do calculations about parabolic motion.		
		12th	Composition and decomposition of forces		Able to composite forces and decompose a force.		
		13th	Balance of forces		Able to do calculations about the balance of forces, action and reaction of forces.		
		14th	Examples of forces		Able to do calculations about elastic forces and frictional forces.		
		15th	Law of inertia and law of motion		Able to do calculations about law of inertia and law of motion.		
		16th	Answer				

2nd Semester	3rd Quarter	1st	Equations of motion for two bodies	Able to derive and solve the equations of motion for two bodies.
		2nd	Slope, frictional force, inertial force	Able to do calculations about objects on slope, frictional force and inertial forces.
		3rd	Impulse and momentum	Able to solve problems using the relationship between impulse and momentum.
		4th	Momentum conservation law	Able to solve problems by using the momentum conservation law.
		5th	Coefficient of restitution	Able to solve problems involving coefficients of restitution.
		6th	Work and power	Able to calculate work and power.
		7th	Mechanical energy 1	Able to calculate kinetic energy and potential energy.
		8th	Midterm exam	
	4th Quarter	9th	Mechanical energy 2	Able to solve the problem by using the law of conservation of mechanical energy.
		10th	Mechanical energy 3	Able to do calculations about conservative force and energy loss.
		11th	Uniform circular motion	Able to do calculations about uniform circular motion.
		12th	Simple harmonic motion 1	Able to calculate velocity and acceleration of an object in simple harmonic motion.
		13th	Simple harmonic motion 2	Able to do calculations about spring pendulum and simple pendulum.
		14th	Universal gravitation 1	Able to do calculations about law of universal gravitation.
		15th	Universal gravitation 2	Able to do calculations about gravitational potential energy.
		16th	Answer	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation/Attitude	Other	Total
Subtotal	60	10	30	0	0	100
Basic Proficiency	30	5	15	0	0	50
Specialized Proficiency	20	5	15	0	0	40
Cross Area Proficiency	10	0	0	0	0	10

Anan College		Year	2024	Course Title	Advanced Chemistry Seminar
Course Information					
Course Code	1413902		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 1	
Department	Course of Chemical Engineering		Student Grade	3rd	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials					
Instructor	Nakamura Atsunobu, Konishi Tomoya, Ota Naotomo, Otani Takashi, Zheng Tao, Ueda Kohei, Sugiyama Yuuki, Ezure Ryosuke				
Course Objectives					
1. Able to summarize various technical information in the field of chemistry into a report. 2. Able to summarize what you hear about business activities into a report.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Able to understand technical information, and summarize it in a report including your own considerations.		Able to understand technical information, and summarize its contents in a report.		Able to understand the basics of technical information, and summarize them in a report.
Achievement 2	Able to understand corporate activities, and summarize them in a report including your own considerations.		Able to understand corporate activities, and summarize those contents in a report.		Able to understand the basics of corporate activities, and summarize them in a report.
Assigned Department Objectives					
学習・教育到達度目標 D-3					
Teaching Method					
Outline	You learn about advanced knowledge in the field of chemistry and the activities of current chemical companies. Specifically, you receive lectures on specialized fields from teachers in the chemistry course, and lectures on corporate activities from lecturers who work for chemical companies. Furthermore, based on the knowledge you have acquired, you plan, implement, and report on events in cooperation with different grades.				
Style	You acquire advanced knowledge in the field of chemistry and knowledge about corporate activities through lectures given by faculty members of the chemistry course and outside lecturers (industries, universities, etc.). For event planning, you are divided into groups. The teachers becomes facilitators.				
Notice	The score will be reduced as you miss report deadlines by a week. If you miss a class, you must submit your report tentatively at Manaba.				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class	<input type="checkbox"/> Instructor Professionally Experienced
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Guidance, Lecture by a chemistry course teacher andan external lecturer, group work1	Able to understand the purpose of this lesson. Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		2nd	Lecture by a chemistry course teacher andan external lecturer, group work2	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		3rd	Lecture by a chemistry course teacher andan external lecturer, group work3	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		4th	Lecture by a chemistry course teacher andan external lecturer, group work4	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		5th	Lecture by a chemistry course teacher andan external lecturer, group work5	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		6th	Lecture by a chemistry course teacher andan external lecturer, group work6	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		7th	Lecture by a chemistry course teacher andan external lecturer, group work7	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	
		8th	Lecture by a chemistry course teacher andan external lecturer, group work8	Able to understand the background and current problems of the lecturer's field of expertise. Able to listen to lecturer and think about your career path.	

	2nd Quarter	9th	Lecture by a chemistry course teacher andan external lecturer, group work9	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		10th	Lecture by a chemistry course teacher andan external lecturer, group work10	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		11th	Lecture by a chemistry course teacher andan external lecturer, group work11	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		12th	Lecture by a chemistry course teacher andan external lecturer, group work12	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		13th	Lecture by a chemistry course teacher andan external lecturer, group work13	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		14th	Lecture by a chemistry course teacher andan external lecturer, group work14	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		15th	Lecture by a chemistry course teacher andan external lecturer, group work15	Able to understand the background and current problems of the lecturer's field of expertise.Able to listen to lecturer and think about your career path.
		16th		

Evaluation Method and Weight (%)

	assignment					Total
Subtotal	100	0	0	0	0	100
Basic Proficiency	30	0	0	0	0	30
Specialized Proficiency	30	0	0	0	0	30
Cross Area Proficiency	40	0	0	0	0	40

Anan College		Year	2024		Course Title	Organic Chemistry 1	
Course Information							
Course Code		1413A01		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		3rd	
Term		Year-round		Classes per Week		前期:2 後期:2	
Textbook and/or Teaching Materials		Fundamentals of ORGANIC CHEMISTRY seventh edition					
Instructor		Sugiyama Yuuki,Otani Takashi					
Course Objectives							
1. The students will learn the concept of chemical bonding and basic knowledge of acids and bases. 2. The students will learn basic knowledge of nomenclature. 3. The students will learn the mechanisms of substitution, elimination, and addition reactions. 4. The students will learn aromaticity and learn basic knowledge of the reactions of aromatic compounds.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Objective 1		Explain the atomic structure and the mechanisms of covalent and ionic bonding, and the mechanisms of acid/base reactions.		Explain the atomic structure and the mechanism of covalent and ionic bonding and about 70% of the mechanism of acid/base reactions.		Explain the atomic structure and the mechanism of covalent and ionic bonding and about 50% of the mechanism of acid/base reactions.	
Objective 2		Write the structures and nomenclature of compounds.		Write about 70% of the structures and nomenclature of compounds.		Write about 50% of the structures and nomenclature of compounds.	
Objective 3		Logically induce the reaction mechanisms of substitution, elimination, and addition reactions of compounds categorized by functional group.		The reaction mechanism of substitution, elimination, and addition reactions of compounds categorized by the functional group is induced by about 70 %.		The reaction mechanism of substitution, elimination, and addition reactions of compounds categorized by the functional group is induced by about 50 %.	
Objective 4		Explain the properties of aromatic compounds and describe electrophilic substitution reactions and their reaction mechanisms.		Explain the properties of aromatic compounds and electrophilic substitution reactions and their reaction mechanisms by about 70%.		Explain the properties of aromatic compounds and electrophilic substitution reactions and their reaction mechanisms by about 50%.	
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline		Organic compounds are important constituents of everyday products and living organisms. Learning about the vast number of organic compounds by rote memorization alone is impossible. However, by classifying them as compounds that exhibit similar physical and chemical properties, it is clear that there are few different organic compounds to memorize. This lecture aims to learn the basics of the properties, reactions, and syntheses characteristic of each functional group that exhibits common properties, as well as the differences in functionality at the molecular level.					
Style		The class will follow the order of the lesson plan for the most part. Organic chemistry is not all about memorization, although there is much to learn individually. This lecture will emphasize that chemical phenomena can be explained logically based on electronegativity, resonance, and the three-dimensional structure of compounds.					
Notice		Organic chemistry is a discipline in which accumulation is significant. Students often fail to master new fields of study without understanding the content of each class. Students should focus on reviewing and studying.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Guidance / Chapter 1: structure and bonding 1		Explain the electron configuration.		
		2nd	Chapter 1: structure and bonding 2		Explain the atomic structure, ionic bonding, and covalent bonding.		
		3rd	Chapter 1: structure and bonding 3		Explain the formation of formal charges and covalent bonds.		
		4th	Chapter 1: acids and bases 1		Explain atomic and hybrid orbitals (s, p, d orbitals, and shapes).		
		5th	Chapter 1: acids and bases 2		Explain the definitions of pKa and Brønsted-Lowry.		
		6th	Chapter 1: acids and bases 3		Explain the definitions of organic acids, organic bases, and Lewis.		
		7th	Chapter 2: alkanes 1		Name Alkanes and cycloalkanes according to IUPAC rules.		
		8th	Early mid-term examination				
	2nd Quarter	9th	Return and explanation of early mid-term examinations Chapter 2: alkanes 2		Explain the steric conformation of the alkanes.		

2nd Semester		10th	Chapter 2: alkanes 3	Explain the steric conformation of cycloalkanes
		11th	Chapter 6: stereochemistry in tetrahedral centers 1	Explain chiral compounds and enantiomers.
		12th	Chapter 6: stereochemistry in tetrahedral centers 2	Name enantiomers according to the R, S notation. Explain specific rotation.
		13th	Chapter 6: stereochemistry in tetrahedral centers 3	Explain diastereomers, meso compounds, racemic mixture and optical resolution.
		14th	Chapter 3: alkenes and alkynes 1	Name Alkenes and cycloalkanes according to IUPAC rules.
		15th	Chapter 3: alkenes and alkynes 2	Explain alkene structures and cis-trans isomers, and make E, Z notation.
		16th	Return and explanation of term-end examination	
	3rd Quarter	1st	Chapter 3: alkenes and alkynes 4	Name alkynes and cycloalkanes according to IUPAC rules.
		2nd	Chapter 3: alkenes and alkynes 5	Explain electrophilic addition reactions of alkenes.
		3rd	Chapter 3: alkenes and alkynes 6	Explain the addition of HX to alkenes.
		4th	Chapter 4: alkenes and alkynes reactions 1	Explain the addition reactions of water, alcohols, and hydrogen to alkenes.
		5th	Chapter 4: alkenes and alkynes reactions 2	Explain regioselectivity in electrophilic addition reactions of alkenes.
		6th	Chapter 4: alkenes and alkynes reactions 3	Explain the oxidation of alkenes. The polymers can be explained.
		7th	Chapter 4: alkenes and alkynes reactions 4	Explain the addition reaction of hydrogen halides to alkynes and the addition reaction of water to alkynes. The acidity of the hydrogen bonded to the sp carbon can be explained.
		8th	Late mid-term examination	
	4th Quarter	9th	Return and explanation of late mid-term examinations Chapter 4: alkenes and alkynes reactions 5	Explain resonance.
		10th	Chapter 4: alkenes and alkynes reactions 6	Explain the reaction of conjugated dienes.
		11th	Chapter 5: aromatic compounds 1	Explain the structure of benzene. Name aromatic compounds according to IUPAC rules.
		12th	Chapter 5: aromatic compounds 2	Explain aromatic electrophilic substitution reactions.
		13th	Chapter 5: aromatic compounds 3	Explain the Frieden-Crafts reaction. Aromatic oxidation and reduction reactions can be explained.
		14th	Chapter 5: aromatic compounds 4	Explain the effect of substituents on orientation.
		15th	Chapter 5: aromatic compounds 5	Explain the definition of aromatics.
		16th	Return and explanation of final examination	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	70	5	0	0	25	100
Basic Proficiency	40	5	0	0	20	65
Specialized Proficiency	30	0	0	0	5	35
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Inorganic Chemistry 1
Course Information					
Course Code	1413B01		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 2	
Department	Course of Chemical Engineering		Student Grade	3rd	
Term	Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials	Inorganic Chemistry: A Modern Approach (Tokyo Kagaku Doujin)				
Instructor	Zheng Tao				
Course Objectives					
1. to be able to understand the structure and electron configuration of atoms 2. to understand the relationship between chemical bonding and the structure and properties of matter 3. to understand solid state chemistry. 4. to understand acids and bases					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Explain the structure and electron configuration of atoms based on the concepts of quantum mechanics		Briefly explain the structure and electron configuration of atoms based on the concepts of quantum mechanics.		Cannot explain the structure and electron configuration of atoms based on quantum mechanical concepts.
Achievement 2	Explain the relationship between chemical bonding and the structure and properties of matter		Can briefly explain the relationship between chemical bonding and the structure and properties of matter.		Cannot explain the relationship between chemical bonding and the structure and properties of matter.
Achievement 3	Understand the bonding and stereology of solids and explain the relationship between bonding patterns and crystal structures		Understand the bonding and stereology of solids, and briefly explain the relationship between bonding modes and crystal structure.		Understands the bonding and stereology of solids and cannot explain the relationship between bonding modes and crystal structure.
Achievement 4	Understand the definitions and strengths of acids and bases, and explain acid-base reactions		Understand the definitions and strengths of acids and bases, and briefly explain acid-base reactions.		Understand the definitions and strengths of acids and bases, and cannot explain acid-base reactions.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	1. to acquire the characteristics and basic knowledge of inorganic chemistry, which covers all elements 2. to systematically study the fundamentals of atomic structure, chemical bonding, molecular structure, molecular orbital theory, and the periodic table; 3. to introduce the definitions and strengths of acids and bases, oxidation-reduction, and battery and electrode reactions 3. to introduce the definitions and strengths of acids and bases, oxidation-reduction and battery/electrode reactions.				
Style	Have students solve simple exercises during the lecture, or give them homework to be solved in the next lecture.				
Notice	This course is based on the content acquired in Chemistry 1 and 2. The course is also designed to deepen students' understanding of organic chemistry, which is offered in parallel with Chemistry 1 and 2. This course is the foundation of Inorganic Materials, Organic Materials, Quantum Chemistry, etc., which are offered in the upper year of the course.				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class	
				<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Contents and areas of inorganic chemistry. Chemical terms, units.	Understand the content and areas of inorganic chemistry and be able to explain chemical terms, units, and concentrations.	
		2nd	Bright line spectrum of hydrogen.	Explain the bright line spectrum of hydrogen.	
		3rd	Bohr model of atoms.	Explain the Bohr model of the hydrogen atom.	
		4th	Wave functions and energy levels of hydrogen-type atoms.	Understand quantization of energy and explain energy levels of hydrogen atoms.	
		5th	Quantum numbers and atomic orbitals.	To be able to explain quantum numbers and atomic orbitals.	
		6th	Angular form of atomic orbitals.	Understand and explain the shapes of s, p, d, and f orbitals.	
		7th	Electron configuration of multi-electron atoms.	Understand penetration and shielding, and explain the electron configuration of multi-electron atoms.	
		8th	Summary and Review	Exercises and Review	
	2nd Quarter	9th	Mid-term exam		
		10th	Electron Configuration and the Periodic Table.	Explain electron configurations and the periodic table.	

2nd Semester		11th	Periodicity of physical properties of elements	To be able to explain the relationship between periodicity of physical properties of elements, ionization energy, and periodicity of electron affinity.
		12th	Lewis structures	To be able to explain Lewis structure based on octet rule.
		13th	VSEPR theory and molecular forms	Understand VSEPR theory and be able to predict molecular and ionic forms using this theory.
		14th	Bond polarity and dipole moments	To be able to explain polarity and dipole moment of molecules. Explain the ionic nature of bonds.
		15th	Summary and review	
		16th	Return of final exam answers	
	3rd Quarter	1st	Valence bond theory 1	To be able to explain valence bond theory and hybridized orbitals.
		2nd	Valence bond theory 2	Explain valence bond theory and hybridized orbitals.
		3rd	Molecular orbital theory 1	Understand bonding and antibonding orbitals and explain electron configuration of isonuclear and heteronuclear diatomic molecules.
		4th	Molecular orbital theory 2	Understand bonding and antibonding orbitals and explain electron configuration of isonuclear and heteronuclear diatomic molecules.
		5th	Types of crystals and their definitions.	Explain the types of crystals and their definitions. 7 types of crystal systems and 4 types of space lattices.
		6th	Structure of metallic crystals	Explain the types and structures of metallic crystals, and calculate the filling factor (porosity) of the densest structures.
		7th	Structure of ionic compounds	Understand the structures of typical ionic crystals and give theoretical explanations of their structures.
		8th	Intermediate Examination	
	4th Quarter	9th	Lattice energies and Born-Haber cycles	Be able to calculate lattice energies using Born-Haber cycles.
		10th	Calculation of lattice energies and Mardelung's constant.	To be able to explain the Mardelung constant and the relationship between lattice energy and melting point, etc.
		11th	Definition of acids and bases.	To be able to explain the definitions of acids and bases.
		12th	Strengths of Bronsted acids and bases.	To be able to explain the strength of Bronsted acids and Bronsted bases.
		13th	Lewis acids and Lewis bases	To be able to explain the definitions of Lewis acids and Lewis bases and their strengths
		14th	Strengths of Lewis acids and Lewis bases.	To be able to explain the concept of HSAB
		15th	Review	
		16th	Return final exam answer sheets	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	30	0	0	0	100
Basic Proficiency	25	0	15	0	0	0	40
Specialized Proficiency	25	0	15	0	0	0	40
Cross Area Proficiency	20	0	0	0	0	0	20

Anan College		Year	2024	Course Title	Analytical Chemistry
Course Information					
Course Code	1413C01		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 2	
Department	Course of Chemical Engineering		Student Grade	3rd	
Term	Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials	Kisobunsekikagaku -ionheikoukarakikibunnsekimade (Sankyo syuppan)				
Instructor	Ueda Kohei,Ezure Ryosuke				
Course Objectives					
1. Understand the solution equilibrium and be able to calculate solubility due to changes in solution composition using the concept of solution equilibrium. Be able to explain the reactions involved in the qualitative analysis of cations and anions. 2. Understand complex formation equilibrium and be able to perform quantitative calculations for chelatometric titration. 3. Understand redox reactions and be able to perform calculations for the redox titration. 4. Understand acid-base equilibrium and be able to perform calculations related to neutralization titration, including pH. Able to explain about buffer solutions. 5. Able to explain ion exchange methods. Understand distribution equilibrium and be able to perform calculations related to solvent extraction methods.					
Rubric					
	Ideal Level		Standard Level		Minimum Level
Achievement 1	Understand and be able to explain solution equilibrium. Be able to calculate solubility due to changes in solution composition using the concept of solution equilibrium. Be able to explain the reactions involved in the qualitative analysis of cations and anions.		Understand and be able to explain solution equilibrium. Be able to explain the reactions involved in the qualitative analysis of cations and anions.		Be able to explain the reactions involved in the qualitative analysis of cations and anions.
Achievement 2	Understand and be able to explain complex formation equilibrium. Be able to perform quantitative calculations for chelatometric titration. Be able to explain the outline of the titration curve and of the indicator.		Understand and be able to explain complex formation equilibrium. Be able to perform quantitative calculations for chelatometric titration.		Understand and be able to explain complex formation equilibrium.
Achievement 3	Understand redox reactions and be able to perform calculations using Faraday's law and Nernst's equation. Be able to perform quantitative calculations for the redox titration. Be able to explain the outline of a titration curve and the method of endpoint determination.		Understand redox reactions and be able to perform calculations using Faraday's law and Nernst's equation. Be able to perform quantitative calculations for the redox titration.		Understand and be able to explain redox reactions.
Achievement 4	Understand and explain acid-base equilibrium. To understand and explain neutralization titration. To be able to explain about buffer solution. To be able to calculate pH of strong acid, strong base, weak base, weak acid, salt of weak acid, and salt of strong base. Can explain the outline of titration curve and necessary indicator settings.		Understand and explain acid-base equilibrium. To understand and explain neutralization titration. To be able to explain about buffer solution. To be able to calculate pH of strong acid, strong base, weak base, weak acid, salt of weak acid, and salt of strong base.		Understand and explain acid-base equilibrium. To understand and explain neutralization titration. To be able to explain about buffer solution.
Achievement 5	Understand and explain separation methods using ion exchange. Understand and explain analytical methods using solvent extraction. Understand, explain, and calculate distribution coefficients, distribution ratios, and extraction rates.		Understand and explain ion exchange separation methods. Understand and explain distribution equilibrium. Understand and explain distribution coefficient, distribution ratio, and extraction ratio.		Understand and explain ion exchange separation methods. Understand and explain distribution equilibrium.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	Analytical chemistry is the study of examining components and their contents in samples and analyzing their chemical structures and states of existence. Although we are not usually aware of it, the techniques and concepts of analytical chemistry are used in a wide range of fields in society, including medicine, food, and the environment. In this lecture, the objective is to master the statistical concepts that form the basis of analytical chemistry, as well as theories related to chemical equilibrium in solution (acid-base equilibrium, complexation equilibrium, precipitation equilibrium, and partition equilibrium).				
Style	The course will proceed through lectures and exercises.				
Notice	A function calculator will be used in the lecture.				
Characteristics of Class / Division in Learning					

<input type="checkbox"/> Active Learning	<input type="checkbox"/> Aided by ICT	<input type="checkbox"/> Applicable to Remote Class	<input type="checkbox"/> Instructor Professionally Experienced
--	---------------------------------------	---	--

Course Plan

			Theme	Goals
1st Semester	1st Quarter	1st	Atomic weight, molecular weight, moles, concentration	Be able to calculate the formula weight amount of a substance from periodic tables. Be able to calculate and convert between concentrations in solution, such as molar concentration, molar fraction, and mass percent concentration.
		2nd	Chemical equilibrium and activity	Understand and be able to explain chemical equilibrium and activity
		3rd	Solubility equilibrium	Understand solubility and solubility product and be able to perform calculations relating to changes in solubility.
		4th	Qualitative inorganic analysis	Understand chemical reactions involving cations and anions and be able to carry out quantitative calculations in solution. Be able to the qualitative analysis of typical cations and anions.
		5th	Gravimetric analysis	Understand the separation of substances by precipitation and be able to calculate the amount of precipitation based on stoichiometry.
		6th	Formation of complexes	Be able to explain the formation of complexes.
		7th	Chelatometric titration	Understand the principle of chelatometric titration and be able to calculate the concentration of metal ions.
		8th	exercises	
	2nd Quarter	9th	midterm exam.	
		10th	Redox reaction	Be able to explain the oxidation numbers.
		11th	Batteries and electromotive force	Be able to explain the redox reactions at the cathode and anode of batteries and to perform calculations using Faraday's law.
		12th	The equilibrium constant for a redox reaction	Understand the Nernst equation and be able to determine the equilibrium constant from the standard EMF of the battery reaction.
		13th	Factors affecting electrode potential	Be able to explain factors affecting electrode potential
		14th	Redox titration	Understand the principle of redox titration and be able to calculate the concentrations of redox agents
		15th	exercises	
		16th	term-end exam.	
2nd Semester	3rd Quarter	1st	Acid and Base Concepts	Able to explain the definitions of acid and base. Able to explain about acid-base equilibrium.
		2nd	Neutral solution and strong acid or strong base solution	Able to explain the definition of pH. Able to calculate strong acids and bases.
		3rd	Aqueous solution of weak acid	Able to calculate dissociation constants and pH of weak acids.
		4th	Aqueous solution of weak base	Able to calculate dissociation constants and pH of weak bases.
		5th	buffer solution	Able to explain the definition of buffer solutions. Able to calculate dissociation constants and pH of buffer solutions.
		6th	Solution of conjugated acid-base pairs	Able to calculate the dissociation constant and pH of a mixture of co-acid-base pairs.
		7th	Polybasic acid and polyacid-base solutions	Able to calculate dissociation constants and pH for polybasic acid and polyacid-base solutions.
		8th		
	4th Quarter	9th	Neutralization titration 1	Able to explain the principle of neutralization titration. Able to perform calculations for titration of strong acids with strong bases.
		10th	Neutralization titration 2	Able to perform calculations for titration of weak acids with strong bases. Able to calculate titration of weak base with strong acid.
		11th	Neutralization titration 3	Able to calculate acid-base indicators Able to calculate buffer indices.
		12th	Solvent extraction method 1	Able to explain distribution equilibrium. Able to calculate distribution equilibrium, distribution coefficient, and extraction ratio.
		13th	Solvent extraction method 2	Able to explain analytical methods using solvent extraction methods.
		14th	Ion exchange method	Able to explain the principles of the ion exchange method.
		15th	Handling of Analysis Data	Able to handle data appropriately.
		16th		

Evaluation Method and Weight (%)

	Examination	Portfolio	Total
Subtotal	70	30	100
Basic Proficiency	20	0	20
Specialized Proficiency	50	30	80

Anan College		Year	2024	Course Title	Physical Chemistry 1
Course Information					
Course Code	1413D04		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	School Credit: 2	
Department	Course of Chemical Engineering		Student Grade	3rd	
Term	Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials	Textbook: 千原秀昭・稲葉章・鈴木晴(訳)「アトキンス物理化学要論」東京化学同人 and 福地賢治編 Professional Engineering Library 「物理化学」 実教出版				
Instructor	Konishi Tomoya				
Course Objectives					
Physical chemistry is a branch of science that attempts to understand chemical phenomena essentially from atomic and molecular structures based on knowledge of physics (e.g., thermodynamics and quantum mechanics) and to express various properties quantitatively (quoted from the textbook "Foreword"). The goals of the lecture are as follows: 1. Explains the states of matter, their characteristics, and the changes of state between phases, and solves related applied problems 2. Explains the difference between ideal gas and real gas and their treatment by equation of state, and solves related application problems 3. Explains radiation and radioactive decay in radioactive materials and solves application problems related to the use of radiation and nuclear energy. 4. Describes equilibrium, kinetics and analysis of chemical reaction by using thermodynamics and solve relevant problems. 5. Describes basics of quantum mechanics and solves basic problms.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Solves exercises on the three states of matter and intermediate phases.		Explains the characteristics of the three states of matter and intermediate phases, as well as critical points, and solves example problems.		Cannot explain the three states of matter and changes of state.
Achievement 2	Treats theoretically the kinetic theory of molecules and velocity distributions for ideal gases and solves exercises.		Treats theoretically the kinetic theory of molecules and velocity distributions for ideal gases and solves example problems.		Unable to explain the properties and laws of ideal gases and solve basic problems using the equation of state.
Achievement 3	Explains the equation of state and generalized diagram of a real gas and solves exercises.		Explains the equation of state and generalized diagram of a real gas and solves example problems.		Cannot explain the difference between an ideal gas and a real gas.
Achievement 4	Explains the properties and uses of radiation and nuclear energy, and solves exercises.		Explains the properties and uses of radiation and nuclear energy, and solves example problems.		Cannot explain the difference between radioactive material, radioactivity, and radiation.
Achievement 5	Solves the problems of equilibrium with few errors.		Demonstrates the general knowledge of equilibrium.		Demonstrates little or no knowledge of equilibrium.
Achievement 6	Solves the problems of chemical kinetics with few errors.		Demonstrates the general knowledge of chemical kinetics.		Demonstrates little or no knowledge of chemical kinetics.
Achievement 7	Solves the problems of reaction analysis with few errors.		Demonstrates the general knowledge of reaction analysis.		Demonstrates little or no knowledge of reaction analysis.
Achievement 8	Solves the problems of basic quantum mechanics with few errors.		Demonstrates the general knowledge of basic quantum mechanics.		Demonstrates little or no knowledge of basic quantum mechanics.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	The course will be offered once a week. In this course, students learn about states of matter, ideal gases, and real gases, and understand how to handle gases using the equation of state. This concept is very useful for handling high-pressure gases in the chemical industry and for designing pressure-resistant vessels and high-pressure reaction vessels. Students will also learn about nuclear reactions of radioactive materials and the characteristics of radiation to deepen their understanding of the use of radiation and nuclear energy. Next, students learn to describe chemical equilibrium, chemical kinetics, and the property of chemical reaction using the knowledge of thermodynamics. This knowledge is indispensable to the manufacturers of chemicals designing materials, temperature, aging, and yield. Students also study basic quantum mechanics for the introduction of quantum chemistry.				
Style	Students are expected to read the textbook and solve preparatory problems in advance. The class will mainly consist of (1) a confirmation test, (2) explanations in the textbook, and (3) exercises. (2) The explanations in the textbook will be based on familiar phenomena and concrete examples, and visual learning through slides and videos will be incorporated. (3) In the exercises, after confirming how to solve example problems, students work alone or in groups to solve exercises to promote the retention of knowledge and skills through experience and to acquire the ability to apply them. Each class will be reviewed using the LMS (manaba) to organize the main points of the study content. [30 hours of class time + 15 hours of self-study]				
Notice	Students are expected to make sure that their knowledge and skills are firmly established through preparation and exercises. The contents covered in physical chemistry cannot be expected to have any learning effect unless the students actually tackle the exercises by themselves.				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class	
				<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	

1st Semester	1st Quarter	1st	States of matter (1) - Three states of matter and state change	Explains the mutual changes in the three states of matter.
		2nd	States of matter (2) - gases and liquids	Basic calculations using the equation of state for ideal gases, the van der Waals equation for real gases, and the Clausius-Clapeyron equation.
		3rd	States of matter (3) - solids and intermediate phases	Explains the crystal structure of solids and the characteristics of liquid crystals and soft viscous crystals as intermediate phases.
		4th	Ideal gas (1) - Properties of ideal gas	Understands the equation of state and be able to calculate temperature, pressure, and volume.
		5th	Ideal gas (2) - Properties of mixed gases	Understands the partial and total pressures of a mixture of gases and be able to calculate the partial and total pressures of an ideal gas from its mole fraction and equation of state.
		6th	Ideal gas (3) - Theory of gas molecular kinetics	Calculates gas pressure from gas molecular kinetics and explains the relationship between temperature and molecular motion.
		7th	Ideal gas (4) - Molecular velocity distribution	Explains that the Maxwell-Boltzmann distribution represents the velocity distribution of molecules, and calculates the mean velocity and mean free path of molecules.
		8th	Exercises	Solves exercises on the content studied in weeks 1-7.
	2nd Quarter	9th	Real gas (1) - Deviation from ideal gas	Explains why real gases deviate from the ideal gas law in terms of molecular size and intermolecular forces of attraction. Explains critical temperatures.
		10th	Real gas (2) - Equation of state	Calculates the p-V _m -T relationship for real gases using the van der Waals or virial equation of state.
		11th	Real gas (3) - Correspondence state principle	Obtains the p-V _m -T relationship for real gases using the generalized Z diagram based on the corresponding state principle.
		12th	Real gases (4) - Application to mixtures	Obtains the p-V _m -T relationship for real mixed gases using the van der Waals equation, the virial equation of state, and a generalized Z diagram.
		13th	Nuclear Reactions and Radiation (1) - Radiation and its Properties	Explains the types and properties of radiation.
		14th	Nuclear Reactions and Radiation (2) - Radioactive Material, Radioactivity, Radiation	Explains the difference between radioactive materials, radioactivity, and radiation, and solves various calculation problems related to radioactive decay.
		15th	Nuclear Reactions and Radiation (3) - Radiation and Nuclear Energy Applications	Explains how radiation and nuclear energy is used and calculate nuclear energy.
		16th	Exercise	Solves exercises on the content studied in weeks 9-15.
2nd Semester	3rd Quarter	1st	Chemical equilibrium (1)	1) Explains the law of mass action. 2) Explains Le Chatelier's principle. 3) Describes the direction of equilibrium shift when concentration, pressure, and temperature change in equilibrium.
		2nd	Chemical equilibrium (2)	1) Explains concentration and pressure equilibrium constants. 2) Describes the pressure equilibrium constant in terms of Gibbs energy. 3) Calculates equilibrium composition (partial pressure) using equilibrium constants.
		3rd	Chemical equilibrium (3)	1) Explains the effect of pressure on chemical equilibrium in terms of pressure equilibrium constants. 2) Explains the effect of temperature on chemical equilibrium using the pressure equilibrium constant. 3) Calculates pressure equilibrium constants at different temperatures using the van't Hoff's equation.
		4th	Chemical equilibrium (4)	1) Describes equilibrium constants for heterogeneous reactions. 2) Describes the temperature dependence of the dissociation pressure. 3) Solves problems involving chemical equilibria of reactions involving solid phases.
		5th	Chemical kinetics (1)	1) Describes and calculates reaction rates in terms of concentrations. 2) Describes reaction rate equations and explain reaction orders. 3) Explains how to determine reaction orders experimentally.
		6th	Chemical kinetics (2)	1) Calculates rate equations for first-order reactions. 2) Calculates rate equations for second-order reactions (unimolecular and bimolecular reactions). 3) Calculates half-lives of reactions.

		7th	Exercise	Solves exercises on the content studied in weeks 1-6.
		8th	Midterm exam.	
	4th Quarter	9th	Property of chemical reaction (1)	1) Formulates rate equations for consecutive reactions and solve problems. 2) Formulates rate equations for reversible reactions and solve problems.
		10th	Property of chemical reaction (2)	1) Explains elementary reactions and rate-limiting steps. 2) Derives rate equations for a group of elementary reactions including a rate-limiting step. 3) Derives rate equations for concomitant reactions.
		11th	Property of chemical reaction (3)	1) Describes the temperature dependence of activation energy and reaction rate. 2) Determines the activation energy using the Arrhenius equation. 3) Describes a catalyst and explains the mechanism of accelerating the rate of a reaction.
		12th	Basic quantum mechanics (1)	1) Describes the background of the birth of quantum theory. 2) Describes the blackbody radiation distribution and the quantum energy hypothesis. 3) Describes the photoelectric effect and the quantum photon hypothesis.
		13th	Basic quantum mechanics (2)	1) Describes the photoelectric effect and the light quantum hypothesis. 2) Describes the line spectrum of hydrogen atoms. 3) Describes Bohr's atomic model.
		14th	Basic quantum mechanics (3)	1) Describes Bohr's quantum condition and frequency condition. 2) Describes the uncertainty principle. 3) Describes the outline of Schrödinger's equation.
		15th	Basic quantum mechanics (4)	1) Derives the time-independent Schrödinger equation. 2) Describes the meaning and properties of wave functions. 3) Solves the Schrödinger equation for a particle in a one-dimensional box.
		16th	Exercise	Solves exercises on the content studied in weeks 9-15.

Evaluation Method and Weight (%)

	Examination	Portfolio	Homework	Total
Subtotal	70	5	25	100
Basic Proficiency	30	5	10	45
Specialized Proficiency	40	0	15	55
Cross Area Proficiency	0	0	0	0

Anan College		Year	2024		Course Title	Chemical Engineering 1	
Course Information							
Course Code		1413E03		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		School Credit: 1	
Department		Course of Chemical Engineering		Student Grade		3rd	
Term		Second Semester		Classes per Week		後期:2	
Textbook and/or Teaching Materials		ベーシック化学工学（化学同人）橋本健治著					
Instructor		Ueda Kohei					
Course Objectives							
1. Understand fluid dynamics and apply it to the design of fluid transport devices. 2. Understand the basic principles of distillation and apply them to the design of distillation towers.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Achievement 1		Understand fluid dynamics and apply it to the design of fluid transport devices.		Understand fluid dynamics and solve basic problems		Understanding the fundamentals of fluid dynamics	
Achievement 2		Understand the basic principles of distillation and apply them to the design of distillation towers.		Understand the basic principles of distillation and solve basic problems		Understand the basic principles of distillation	
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline		Chemical engineering is a field of engineering that deals with the operation and design of chemical plants. This course introduces the unit operations of (1) transport phenomena involving fluid dynamics, material balance, and energy balance, and (2) the distillation process through gas-liquid equilibrium.					
Style		Assignments will be given for each lecture. The assignments will help you review and prepare for the lecture. Short exercises will be given during the class. Please remember to bring your calculator.					
Notice		If you have any questions, please ask them in class. No questions will be accepted during the exam period.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester	3rd Quarter	1st	Fluid transfer principles and equipment		Understand fluid properties and the structure of pumps.		
		2nd	Equation of continuity		Apply the equation of continuity.		
		3rd	Bernoulli's principle		Apply Bernoulli's principle.		
		4th	Viscosity		Understand fluid viscosity.		
		5th	Reynolds number		Calculate the Reynolds number.		
		6th	Friction losses in pipe flow		Determine the friction losses in the pipe flow.		
		7th	Power requirements for fluid transport.		Determine power requirements for fluid transport.		
		8th	Midterm examination				
	4th Quarter	9th	Distillation principles and equipment		Understand the structure of distillation equipment.		
		10th	Vapor-liquid equilibrium 1		x-y diagram		
		11th	Vapor-liquid equilibrium 2		Antoine equation		
		12th	Simple distillation		Rayleigh's equation for single distillation.		
		13th	Continuous distillation 1		Determine the theoretical plate number of a distillation tower using the McCabe-Thiele method.		
		14th	Continuous distillation 2		Understand the principle of theoretical plate number determination.		
		15th	Continuous distillation 3		Understand the principle of theoretical plate number determination.		
		16th	Final examination				
Evaluation Method and Weight (%)							
	Examination		Quiz	Portfolios	Other	Total	
Subtotal	70		10	20	0	100	
Basic Proficiency	0		0	0	0	0	
Specialized Proficiency	70		10	20	0	100	
Cross Area Proficiency	0		0	0	0	0	

Anan College		Year	2024		Course Title	Biology
Course Information						
Course Code		1413G01		Course Category	Specialized / Compulsory	
Class Format		Lecture		Credits	School Credit: 2	
Department		Course of Chemical Engineering		Student Grade	3rd	
Term		Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials		first term :seibutsu, Asashima et al., Tokyo shoseki				
Instructor		Ota Naotomo,Otani Takashi				
Course Objectives						
1. to be able to explain the origin of life and the evolution of organisms 2. can explain the structure and function of cells and proteins, and their metabolism 3. to be able to explain the structure and function of genes and the central dogma 4. to be able to explain the expression of genetic information and development						
Rubric						
		Ideal Level		Standard Level		minimum Level
Achievement 1		Can explain in detail the origin of life and the evolution of organisms		Can explain the origin of life and the evolution of organisms		Can understand the origin of life and the evolution of organisms
Achievement 2		can explain in detail the structure and function of cells and proteins, and their metabolism		can explain the structure and function of cells and proteins, and their metabolism		can understand the structure and function of cells and proteins, and their metabolism
Achievement 3		to be able to explain in detail the structure and function of genes and the central dogma		to be able to explain the structure and function of genes and the central dogma		to be able to understand the structure and function of genes and the central dogma
Achievement 5		to be able to explain in detail the expression of genetic information and development		to be able to explain the expression of genetic information and development		to be able to understand the expression of genetic information and development
Assigned Department Objectives						
学習・教育到達度目標 A-3 学習・教育到達度目標 D-1 学習・教育到達度目標 D-4						
Teaching Method						
Outline		The first semester is the "Biology" range of the high school course. Based on "Basic Biology" in the second year, this course deals with a wider range of organisms and biological phenomena, and develops students' abilities and attitudes toward biological inquiry. Students will deepen their understanding of the basic concepts and principles of biology and acquire a scientific view of nature.				
Style		Check the content of the preliminary study through quizzes, and develop thinking and judgment skills through exercises.				
Notice						
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester	1st Quarter	1st	Origin of Life, Cell Evolution	Can explain the origin of life and cell evolution		
		2nd	Sexual reproduction and meiosis	Can xplain the sexual reproduction and meiosis		
		3rd	Genetic Mechanisms	Can explain the genetic Mechanisms		
		4th	Evolutionary Mechanisms	Can explain the evolutionary mechanisms		
		5th	Structure and function of cells, biomembranes, and eukaryotic cells	To be able to explain the structure and function of cells, biomembranes, and eukaryotic cells		
		6th	Protein structure, enzymes and reaction regulation	Can explain the protein structure, enzymes and reaction regulation		
		7th	Assimilation and catabolism, respiration, fermentation and glycolysis	To be able to explain the assimilation and catabolism, respiration, fermentation and glycolysis		
		8th	Photosynthesis, chemosynthesis, nitrogen assimilation	To be able to explain the Photosynthesis, chemosynthesis, nitrogen assimilation		
	2nd Quarter	9th	midterm examination			
		10th	Gene structure and replication, central dogma	To be able to explain the gene structure and replication, central dogma		
		11th	Transcription and translation, changes in genetic information	To be able to explain the transcription and translation, changes in genetic information		
		12th	Development and gene expression	Can explain the development and gene expression		
		13th	Animal Development	Can explain the Animal Development		
		14th	Embryogenesis and gene expression	Can explain the embryogenesis and gene expression		
		15th	gene technology	Can explain the gene technology		
		16th	Final Examination			

2nd Semester	3rd Quarter	1st		
		2nd		
		3rd		
		4th		
		5th		
		6th		
		7th		
		8th		
	4th Quarter	9th		
		10th		
		11th		
		12th		
		13th		
		14th		
		15th		
		16th		

Evaluation Method and Weight (%)

	Examination	quiz	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	30	0	0	0	0	100
Basic Proficiency	70	30	0	0	0	0	100
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Experiments in Materials Chemistry and Exercises 1	
Course Information							
Course Code		1413T05		Course Category		Specialized / Compulsory	
Class Format		実験・演習		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		3rd	
Term		First Semester		Classes per Week		前期:4	
Textbook and/or Teaching Materials		An original textbook published by the chemistry course					
Instructor		Ueda Kohei,Konishi Tomoya,Nakamura Atsunobu,Zheng Tao,Ezure Ryosuke					
Course Objectives							
Master basic experimental techniques in a physical chemistry field and understand kinetic theory of gases, chemical equilibrium, and chemical kinetics. Be able to collaborate with others in the team to conduct experiments and organize data To acquire the ability to apply principles and the ability to plan, organize data, and write reports on the content of process design.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Achievement 1		Be able to solve applied problems related to each experimental topic.		Be able to solve basic problems related to each experimental theme.		To be able to explain basic knowledge of each experimental theme.	
Achievement 2		To be able to set up an original problem as well as a question when writing a report, and to be able to consider it logically.		To be able to consider the questions logically when writing a report.		To be able to write a logical discussion in a report.	
Achievement 3		Write easy-to-read reports using figures, tables, and schematic diagrams.		To be able to write scientific texts according to the report format.		To be able to write scientific texts.	
Achievement 4		Recognize their role in a team and act independently.		Communicate and cooperate within a team.		To be able to work in a team and conduct experiments.	
Assigned Department Objectives							
学習・教育到達度目標 B-4 学習・教育到達度目標 D-2 学習・教育到達度目標 D-4							
Teaching Method							
Outline		Physical chemistry is the study of the structure, properties, and reactions of matter, and also plays an important role in organic chemistry, inorganic chemistry, analytical chemistry, and chemical engineering. Understand the basic concepts of kinetic theory of gases, chemical equilibrium, and chemical kinetics. In addition, understand structure determination of molecules and crystals using infrared spectroscopy and X-ray diffraction. It also enhances the development of students' ability to explain chemical knowledge and write logical scientific reports.					
Style		The course combines experiments and exercises. Lectures will also be given on some experimental topics.					
Notice		Bring a white lab coat, safety goggles, indoor shoes, a lab notebook, and a scientific calculator. In principle, all experiments must be carried out to be graded. Experiment topics may be changed depending on circumstances, such as equipment failure. Reports with less than the standard score may be resubmitted or rejected. If a report is not submitted by the due date, points will be deducted. If there is something you do not understand, you should study it using textbooks or specialized books available in the library before experimenting.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Orientation and Review		Learn the experimental mindset, evaluation methods, and how to write experimental notes and reports. Review basic skills.		
		2nd	Ideal gas law		Measure the pressure, volume, and temperature of gases and understand the ideal gas law.		
		3rd	Data organization and statistics		Organize data obtained from experiments and calculate various basic statistics.		
		4th	Correlation coefficient		Derive correlation coefficients and fitting curves for data with errors.		
		5th	Heat of Reaction		Explain the experimental method for measuring the heat of reaction and obtain it experimentally.		
		6th	Brownian motion		Understand the properties of molecular motion by observing the Brownian motion of colloids.		
		7th	Reaction rate		Measure the decomposition rate of hydrogen peroxide water, determine the reaction rate and activation energy of it.		
		8th	Viscosity Measurement		Explain the experimental method for determining the viscosity of EtOH aq. and obtain it experimentally.		
	2nd Quarter	9th	midterm exam				
		10th	Preparation of silver samples		Prepare silver samples for using powder X-ray diffraction measurements.		

		11th	Lecture: Infrared absorption spectrum measurement and analysis (1) Lecture: Powder X-ray diffraction measurement and analysis (1)	Explain the principle, measurement method, and analysis method of infrared absorption spectrum and powder X-ray diffraction measurements.
		12th	Powder X-ray diffraction measurement and analysis (2)	Determine lattice constants and crystal structures of Ag and AgCl by using the powder X-ray diffraction.
		13th	Infrared absorption spectrum measurement and analysis (2)	Determine the interatomic bond distances of HCl in a gas phase from its rotational level energies observed from the infrared absorption spectrum.
		14th	Electromotive Force Measurement	Measure the electromotive force of a Daniel battery and a concentration cell, and explain the composition and mechanism of the battery.
		15th	Freezing point depression	Measure freezing point depressions and estimate the molecular weight of the solute.
		16th	final exam	

Evaluation Method and Weight (%)

	Experiment report	Other	Total
Subtotal	60	40	100
Basic Proficiency	20	10	30
Specialized Proficiency	40	20	60
Cross Area Proficiency	0	10	10

Anan College		Year	2024		Course Title	Experiments in Materials Chemistry and Exercises 2	
Course Information							
Course Code		1413T06		Course Category		Specialized / Compulsory	
Class Format		実験・演習		Credits		School Credit: 2	
Department		Course of Chemical Engineering		Student Grade		3rd	
Term		Second Semester		Classes per Week		後期:4	
Textbook and/or Teaching Materials		Text printouts to be distributed					
Instructor		Ezure Ryosuke,Zheng Tao,Ueda Kohei,Ota Naotomo,Otani Takashi					
Course Objectives							
To acquire experimental techniques related to molecular motion, equilibrium theory, and kinetics, which are the foundation of physical chemistry. To be able to explain the principles of fluid flow and heat transfer from the viewpoint of mass balance and energy balance, and to master their operation. To be able to explain the principles of gas-liquid separation (distillation), drying, adsorption, and powder, and to be able to operate them. To master the basic operations for culturing microorganisms. Extract, separate, and analyze biological materials Observe issues in biodiversity conservation and understand the current situation Be able to collaborate with others in the team to conduct experiments and organize data To acquire the ability to apply principles and the ability to plan, organize data, and write reports on the content of process design. Translated with www.DeepL.com/Translator (free version)							
Rubric							
		Ideal Level		Standard Level		Unacceptable Level	
Achievement 1		Be able to solve applied problems related to each experimental topic.		Be able to solve basic problems related to each experimental theme.		To be able to explain basic knowledge of each experimental theme.	
Achievement 2		To be able to set up an original problem as well as a question when writing a report, and to be able to consider it logically.		To be able to consider the questions logically when writing a report.		To be able to write a logical discussion in a report.	
Achievement 3		Write easy-to-read reports using figures, tables, and schematic diagrams.		To be able to write scientific texts according to the report format.		To be able to write scientific texts.	
Achievement 4		Recognize their role in a team and act independently.		Communicate and cooperate within a team.		To be able to work in a team and conduct experiments.	
Assigned Department Objectives							
学習・教育到達度目標 D-2 学習・教育到達度目標 D-4							
Teaching Method							
Outline		Chemical Engineering Laboratory] Knowledge of chemical engineering must be applied to originality and applied aspects, and experiments and practical training are essential for learning. Students will directly touch the equipment to understand the configuration and operation of the equipment, as well as to understand the theory and calculation formulas by comparing them with the experimental data. Biotechnology Experiments In the first half of the course, students learn the experimental methods that form the basis of biotechnology and acquire knowledge of microbiology and biochemistry through experiments. In the second half, students will observe, record, and discuss issues in biodiversity conservation (increase in endangered species due to development) in the field, and understand the current situation toward biodiversity conservation.					
Style		Chemical Engineering Experiment] Students learn how to take data and analyze data by operating experimental apparatuses for each theme, learn how to engineer the phenomena occurring in the apparatuses, and gain a deep understanding of the substances, momentum, energy balance, and principles used in the analysis through experiments. Through experiments, students will gain a deep understanding of the material, momentum, energy balance, and principles used in the analysis. In addition, students will learn practical techniques through hands-on training in equipment operation and piping. Biotechnology Experiments Experiments and Lectures					
Notice		Remember to bring a lab coat, safety glasses, jacket, lab notebook, and a function calculator. If there is anything in the text that you do not understand, it is recommended that you look up the textbook or a specialized book in the library. In principle, all experiments must be performed. The experimental topics may be changed depending on the situation, such as equipment failure. Chemical Engineering Experiments The course builds on the content acquired in "Fundamentals of Chemical Engineering" and "Chemical Engineering 1. It is desirable to have a good understanding of mathematics, physics, physical chemistry, and chemical engineering.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester	3rd Quarter	1st	Orientation】 【Orientation		Able to prepare equipment for biotechnology experiments, including sterilization and aseptic manipulation.		
		2nd	Sterilization and aseptic manipulation		Can culture microorganisms.		

		3rd	Biotechnology Experiment] Culture of Microorganisms	To be able to observe biological samples using an optical microscope.
		4th	Biotechnology Experiments] Optical Microscopy	
		5th	Mid-term examination	Understand how to prepare for experiments, how to evaluate, and how to write laboratory notebooks and reports. To review single distillation.
		6th	Orientation to Chemical Engineering Experiments	Understand the principles of distillation and be able to perform calculations for data analysis. Understand the principles and laws of mass transfer in liquids and be able to calculate mass balance.
		7th	Chemical Engineering Experiments] Monodistillation of water-methanol	Understand the principles of drying as a unit operation and be able to calculate data analysis. To be able to estimate equilibrium moisture content and limiting moisture content.
		8th	Chemical Engineering Experiments] Drying Solids	Understand the principle of adsorption as a unit operation and be able to calculate data analysis. To be able to draw adsorption isotherms.
	4th Quarter	9th	Adsorption of Acetic Acid on Activated Carbon in Liquid Phase (1)	To be able to operate adsorption, measure and calculate the amount of adsorption.
		10th	Adsorption of Acetic Acid on Activated Carbon in the Liquid Phase (2)	To be able to draw adsorption isotherms. To be able to calculate specific surface area of porous materials.
		11th	Adsorption of Acetic Acid by Activated Carbon in Liquid Phase (3)	Be able to explain frictional losses in circular tubes and be able to calculate friction coefficients and prepare Moody diagrams using flow rates and pressures.
		12th	Chemical engineering experiment] Particle size distribution	Understand the principles and operation of the sieving method and be able to prepare a particle size distribution diagram.
		13th	Chemical engineering experiment] Distillation column	Understand the principles of distillation columns and be able to perform data analysis calculations.
		14th	Friction Loss of Circular Tubes	To be able to explain how to measure various physical properties measured in a chemical plant, such as flow rate, velocity measurement, and temperature.
		15th	Particle Size Distribution, Friction Loss of Circular Tubes	
		16th	Return of final examinations】 【Final Examinations	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	30	60	0	0	0	10	100
Basic Proficiency	30	60	0	0	0	10	100
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Fundamental Physics 2
Course Information						
Course Code		1414301		Course Category	Specialized / Compulsory	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade	4th	
Term		Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials		担当教員作成・配布資料				
Instructor		Yoshida Takehito				
Course Objectives						
1. 熱力学第1、第2法則を理解し、関連した問題を解析的手法で解き、定量的解を得ることができる。 2. エントロピーと熱力学基本法則を理解し、関連した問題を解析的手法で解き、定量的解を得ることができる。 3. ギブス分布・マックスウェルの速度分布則・ボルツマンの原理・分配関数の概念を理解し、定量的取り扱いができる。 4. 古典粒子系の物理量の期待値（熱力学的諸量）を、統計的手法を用いて、定量的に導出することができる。						
Rubric						
		理想的な到達レベルの目安	標準的な到達レベルの目安	未到達レベルの目安		
評価項目1		熱力学第1、第2法則を理解し、関連した問題を代数・解析的手法で解き、定量的解を得られる。	熱力学第1、第2法則を理解し、関連した問題を代数・解析的手法で考察し、定性解をえられる。	熱力学第1、第2法則を理解し、関連した問題を代数・解析的手法で考察し、解を得ることができない。		
評価項目2		エントロピーと熱力学基本法則を理解し、関連した問題を代数・解析的手法で解き、定量的解を得られる。	エントロピーと熱力学基本法則を理解し、関連した問題を代数・解析的手法で考察し、定性解をえられる。	エントロピーと熱力学基本法則を理解し、関連した問題を代数・解析的手法で考察し、定性解を得ることができない。		
評価項目3		ギブス分布・マックスウェルの速度分布則・ボルツマンの原理・分配関数、の応用的定量活用ができる。	ギブス分布・マックスウェルの速度分布則・ボルツマンの原理・分配関数の定量解を得ることができる。	ギブス分布・マックスウェルの速度分布則・ボルツマンの原理・分配関数の概略を得ることができる。		
評価項目4		応用的古典粒子系の物理量の期待値（熱力学的諸量）を、統計的手法を用いて、応用的課題において定量的解を導出できる	古典粒子系の物理量の期待値（熱力学的諸量）を、統計的手法を用いて、定量的に導出できる。	古典粒子系の物理量の期待値（熱力学的諸量）を、統計的手法を用いて、概略的定量解を得ることができる。		
Assigned Department Objectives						
学習・教育到達度目標 B-3						
Teaching Method						
Outline	本講義は、自然科学の基本となる古典物理学の中で19世紀に確立した熱力学，およびミクロスコピックな自然現象理解の端緒となる統計力学の初歩について、一貫した論理体系として把握させる。演習問題を多く取り入れることで問題解決能力を養い、工学分野への応用能力を身につける。工学応用で重要となる物質の性質を数理科学的に理解することを学ぶ。この科目は企業で、半導体集積素子の設計及び製造プロセスの研究・開発を担当していた教員が、その経験を活かし、平衡状態の熱力学および統計力学の基礎について講義形式で授業を行うものである。					
Style	授業内容は授業計画を参照すること。基本的に講義形式をとる。板書が主体であるが、関連資料のスライド紹介も取り入れる。学生への発問はするので（3-5回/1コマ），積極的に答えること。指名されない学生も積極的に考えること。計15回（計約60問）の課題は、自主的に考えて解き問題解決の力を養うこと。終盤では自学自習課題の解法をスライドを用いて発表させる。					
Notice	4年生までの数学系科目と「物理1, 2, 3」「物理化学3」でに学んだ物理の内容を前提として活用するので、これらの内容をしっかり復習しておくこと。また授業各回毎に出された課題の実施を含む自学自習が不可欠である。授業時間内に自学自習課題の解説を十分に行うことは不可能なので、疑問点があれば質問に来ること。質問にあたっては、先ず自分で調べ考えてみて、何が理解できなかったのかをはっきりさせてから質問に来ること。 参考書：砂川重信, 物理の考え方「熱・統計力学の考え方」（岩波書店）					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester	3rd Quarter	1st	1. 熱力学の基礎	熱力学の基礎概念を理解し定性的説明と計算ができる		
		2nd	1. 熱力学の基礎	熱力学第1法則に関する問題を代数もしくは解析的手法で計算できる		
		3rd	1. 熱力学の基礎	熱力学第2法則に関する問題を代数もしくは解析的手法で計算できる		
		4th	1. 熱力学の基礎	エントロピーに関する問題を代数もしくは解析的手法で計算できる		
		5th	1. 熱力学の応用	不可逆過程を含む熱力学的問題を代数もしくは解析的手法で計算できる		
		6th	1. 熱力学の応用	不可逆過程を含む熱力学的問題を代数もしくは解析的手法で計算できる		
		7th	1. 熱力学の応用	一般の熱機関の効率・クラペイロン-クラウジウスの法則に関する計算ができ熱力学的問題に適用し代数・解析的解を得ることができる		
		8th	中間試験			
	4th Quarter	9th	2. 統計力学の基本	熱力学におけるヘルムホルツの自由エネルギーから熱力学的諸量を計算できる。ガンマ空間の概念を理解し定性的に説明できる		

		10th	2. 統計力学の基本	平等確率の仮説を理解し定性的に説明できる．ギブス分布を導出し物理的意味を説明できる
		11th	2. 統計力学の基本	マックスウェルの速度分布則を導出し分子速度に関する諸量を計算できる
		12th	2. 統計力学の基本	ボルツマンの原理と分配関数の物理的意味を理解し説明できる
		13th	2. 統計力学の基本	分配関数と自由エネルギーの関係を導出できてその意味を説明できる
		14th	3.統計力学の応用	相互作用のない粒子系の物理量期待値を計算できる．理想気体の状態方程式を理論的に導出できる
		15th	3.統計力学の応用	固体における原子間相互作用のない比熱モデル（デュロン・プティ（古典），アインシュタイン（量子））を導出でき，固体の比熱を温度の関数として導出することができる
		16th	期末試験答案返却及び解説	

Evaluation Method and Weight (%)

	試験	発表	相互評価	態度	ポートフォリオ	自学自習課題	Total
Subtotal	60	0	0	0	0	40	100
基礎的能力	20	0	0	0	0	10	30
専門的能力	30	0	0	0	0	20	50
分野横断的能力	10	0	0	0	0	10	20

Anan College		Year	2024		Course Title	Organic Chemistry 2
Course Information						
Course Code	1414A10		Course Category	Specialized / Compulsory		
Class Format	Lecture		Credits	Academic Credit: 2		
Department	Course of Chemical Engineering		Student Grade	4th		
Term	First Semester		Classes per Week	前期:2		
Textbook and/or Teaching Materials	Fundamentals of ORGANIC CHEMISTRY seventh edition					
Instructor	Sugiyama Yuuki					
Course Objectives						
1. The student will name alcohols, ethers, carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones 2. The student will describe the general properties, synthetic methods, and reactions of alcohols and ethers 3. The student will describe common reactions and products of carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones and the differences in their reactivity.						
Rubric						
	Ideal Level		Standard Level		Minimum Level	
Objective 1	Write the nomenclature of alcohols, ethers, carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones.		Write about 70% of the nomenclature of alcohols, ethers, carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones.		Write about 50% of the nomenclature of alcohols, ethers, carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones.	
Objective 2	Accurately describe the general properties, synthetic methods, and reactions of alcohols and ethers, and plan synthetic methods.		Accurately describe the general properties, synthetic methods, and reactions of alcohols and ethers.		Describe the general properties, synthetic methods, and reactions of alcohols and ethers.	
Objective 3	Accurately describe the general reactions and products of carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones, as well as the differences in their reactivities, and plan synthetic methods.		Accurately describe the general reactions and products of carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones, as well as the differences in their reactivities.		Describe the general reactions and products of carboxylic acids, carboxylic acid derivatives, aldehydes, and ketones, as well as the differences in their reactivities.	
Assigned Department Objectives						
学習・教育到達度目標 D-1						
Teaching Method						
Outline	In this lecture, students learn about reactions and chemical phenomena characteristic of each "functional group" based on the same concept as organic chemistry (3rd year). Students also learn about organic materials that take advantage of the characteristics of functional groups.					
Style	The lecture will follow almost the order of the lesson plan. The course will emphasize that chemical phenomena can be logically explained based on electronegativity, resonance, and the three-dimensional structure of compounds.					
Notice	Organic chemistry is a discipline in which accumulation is significant, and knowledge of organic chemistry in the third year is essential for this lecture. Students are required to review and study the material.					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester	1st Quarter	1st	Chapter 7: Substitution and Elimination Reactions of Alkyl Halides 1	Explain the SN2 reaction.		
		2nd	Chapter 7: Substitution and Elimination Reactions of Alkyl Halides 2	Explain the SN1 reaction.		
		3rd	Chapter 7: Substitution and Elimination Reactions of Alkyl Halides 3	Explain the E1 and E2 reaction		
		4th	Chapter 7: Substitution and Elimination Reactions of Alkyl Halides 4	Explain the competition between substitution and elimination reactions.		
		5th	Chapter 8: Reactions of Alcohols, Ethers, and Epoxides 1	Name alcohols according to IUPAC rules. Explain the alcohol substitution reactions.		
		6th	Chapter 8: Reactions of Alcohols, Ethers, and Epoxides 2	Explain the synthesis, elimination, and oxidation reactions of alcohols.		
		7th	Chapter 8: Reactions of Alcohols, Ethers, and Epoxides 3	Name ethers and epoxides according to IUPAC rules. Explain the ether and epoxide reactions.		
		8th	Mid-term examination			
	2nd Quarter	9th	Return and explanation of mid-term examinations Chapter 11: Carbonyl Compounds I-1	Name aldehydes and ketones according to IUPAC rules. Explain the aldehyde and ketone structure and physical properties.		
		10th	Chapter 11: Carbonyl Compounds I-2	Using reaction mechanisms, explain the reaction of aldehydes and ketones with hydrides, amines, water, and alcohols.		

		11th	Chapter 11: Carbonyl Compounds I-3	Using reaction mechanisms, explain the reaction of aldehydes and ketones with hydrides, amines, water, and alcohols.
		12th	Chapter 11: Carbonyl Compounds I-4	Explain the Wittig reaction.
		13th	Chapter 10: Carbonyl Compounds II-1	Name carbonyl compounds according to IUPAC rules. Explain the carbonyl compound structure and physical properties.
		14th	Chapter 10: Carbonyl Compounds II-2	Explain the reaction of carboxylic acid derivatives.
		15th	Chapter 10: Carbonyl Compounds II-3	Using reaction mechanisms, explain acylation, esterification, and amidation reactions.
		16th	Return and explanation of final examination	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	70	0	0	0	30	100
Basic Proficiency	30	0	0	0	10	40
Specialized Proficiency	40	0	0	0	20	60
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Advanced Organic Chemistry
Course Information						
Course Code		1414A11		Course Category	Specialized / Compulsory	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade	4th	
Term		Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials		Organic Chemistry Problem Collection (Shoukabo), Fundamentals of ORGANIC CHEMISTRY seventh edition (Tokyo Kagaku Doujin)				
Instructor		Sugiyama Yuuki				
Course Objectives						
1. The students will determine the structure of organic compounds 2. The students will discuss electrophilic addition and substitution reactions. 3. The students will discuss nucleophilic addition and substitution reactions.						
Rubric						
		Ideal Level		Standard Level		Minimum Level
Objective 1		Accurately determine organic compounds' structure and predict unknown compounds' structure.		Accurately determine organic compounds' structure.		Determine organic compounds' structure.
Objective 2		Accurately explain electrophilic addition and substitution reactions and predict reaction results and synthetic methods.		Accurately explain electrophilic addition and substitution reactions.		Explain electrophilic addition and substitution reactions.
Objective 3		Accurately describe nucleophilic addition and substitution reactions and predict reaction results and synthetic methods.		Accurately describe nucleophilic addition and substitution reactions.		Describe nucleophilic addition and substitution reactions.
Assigned Department Objectives						
Teaching Method						
Outline		The objective of this course is to understand chemical phenomena common to each group of compounds by functional group, to be able to predict reaction results and synthesis methods of organic compounds, and to develop the ability to determine structures.				
Style		A self-study assignment will be given each week. The assignments will consist of similar problems from that week, as well as confirmation of the basic points covered in preparation for the next week's lesson.				
Notice						
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester	3rd Quarter	1st	Chapter 11, Carbonyl Compounds III-1	Explain keto-enol tautomerism.		
		2nd	Chapter 11, Carbonyl Compounds III-2	Explain malonic ester synthesis.		
		3rd	Chapter 11, Carbonyl Compounds III-3	Explain aldol reactions and Claisen condensation using reaction mechanisms.		
		4th	Chapter 13, Structure Determination of Organic Compounds 1	Describe mass spectrometry and determine the molecular formula of an organic compound from the data.		
		5th	Chapter 13, Structure Determination of Organic Compounds 2	Explain the IR and determine the functional groups of organic compounds from the data.		
		6th	Alkanes	Explain the nomenclature and stereo configuration of alkanes. Explain the synthetic methods for alkanes.		
		7th	Alkenes	Explain the reaction results and synthesis of alkenes (electrophilic addition reactions).		
		8th	Mid-term exam			
	4th Quarter	9th	Alkynes	Explain the reaction results and synthesis of alkynes (electrophilic addition reactions).		
		10th	Aromatic compounds	Define aromatic compounds and explain reaction results and synthetic methods.		
		11th	Aromatic compounds	Explain electrophilic substitution reactions.		
		12th	Alkyl Halides	Explain nucleophilic substitution reactions.		
		13th	Alcohols and Ethers	Explain the reaction results and synthesis of alcohols and ethers.		
		14th	Carbonyl Compounds 1	Explain the results of reactions (aldehydes and ketones, etc.) and synthetic methods of carbonyl compounds.		
		15th	Carbonyl Compounds 2	Explain the results of reactions (carboxylic acid derivatives, etc.) and synthetic methods of carbonyl compounds.		
		16th	Return of final exam papers			

Evaluation Method and Weight (%)						
	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	60	0	0	0	40	100
Basic Proficiency	40	0	0	0	20	60
Specialized Proficiency	20	0	0	0	20	40
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Inorganic Chemistry 2
Course Information					
Course Code	1414B10		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Chemical Engineering		Student Grade	4th	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	Inorganic Chemistry: A Modern Approach (Tokyo Kagaku Doujin)				
Instructor	Zheng Tao				
Course Objectives					
1. to understand the periodicity of the elements and the relationship between the structure of the nucleus and the state of the outer electrons and the properties of the elements. 2. to be able to understand the structure and nomenclature of complexes, properties such as magnetism and color, and theories such as valence bond theory and crystal field theory.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Explain the properties and classification of elements. Explain all properties of elements and compounds in each block.		Explain the properties and classification of elements. To be able to explain the properties of elements and compounds of each block.		Explain the properties and classification of elements. Briefly explain the properties of elements and compounds in each block.
Achievement 2	Explain coordination bonds, the definition of coordination compounds, and their structures. To be able to explain isomers of complexes and draw all structures.		To be able to explain the definition and structure of coordination bonds and coordination compounds. To be able to explain isomers of complexes and to draw their structures.		To be able to explain the definition and structure of coordination bonds and coordination compounds. To be able to explain isomers of complexes.
Achievement 3	To be able to explain all about valence bond theory and crystal field theory. To be able to explain the relationship between crystal field splitting, magnetism and color of complexes.		To be able to explain valence bond theory and crystal field theory. To be able to explain the relationship between crystal field splitting, magnetism and color of complexes.		To be able to explain about valence bond theory and crystal field theory. To be able to explain about the relationship between crystal field splitting, magnetism and color of complexes.
Achievement 4	To be able to explain stability and reaction of complexes. To be able to calculate all stability constants and concentrations.		To be able to explain stability and reaction of complexes. To be able to calculate stability constants and concentrations		To be able to explain the stability and reactions of complexes in simple terms To be able to perform basic calculations related to stability constants and concentrations
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	The properties of elements depend on the properties of electrons moving around the nucleus. In the first half of this lecture, the structure, synthesis, and physical properties of major elements and inorganic compounds composed of them will be explained, while being aware of similarities and differences among homologous elements. In the second half of the lecture, the definition and structure of complexes, valence bond theory, crystal field theory, and other theories, as well as properties such as magnetism and color of complexes, will be explained. *Relationship with Practice This course is taught by faculty members who have been in charge of research and development related to inorganic materials such as electrode materials in companies, and they use this experience to teach inorganic chemistry in a lecture format.				
Style	In the first half of the lecture, the group will investigate and present the properties of elements and compounds of each family. All class members will answer questions prepared by the group. Group members will answer questions.				
Notice	Reference books Schreiber Inorganic Chemistry (Upper and Lower), Tokyo Kagaku Doujin				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class	
				<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
1st Semester r	1st Quarter	1st	Coordination compounds (metal complexes) and coordination bonds. Structure of complexes.	1. Explain th coordination compounds and coordination bonds 2. Explain the structure of complexes.	
		2nd	Nomenclature of coordination compounds. Isomers of complexes.	1. Explain the nomenclature of coordination compounds. 2. Explain isomers of complexes and draw isomeric structures.	
		3rd	Valence bond theory and magnetism of complexes.	Explain valence bond theory and use this theory to explain the magnetism of complexes.	
		4th	Overview of crystal field theory.	Explain crystal field theory and crystal field splitting.	

		5th	Crystal fields and electronic states of metal ions.	Explain crystal field stabilization energies and the electronic states of metal ions.
		6th	Electronic structure and spectroscopy of complexes	1. Explain d-d transitions, spectrochemical series, etc. 2. Explain the relationship between energy ranking and the color of complexes.
		7th	Stability and reaction of complexes	Explain equilibrium and stability constants of complexes in aqueous solution.
		8th	Intermediate test	
	2nd Quarter	9th	Oxidation and reduction reactions	Explain oxidation/reduction reactions, oxidizing and reducing agents, and write redox reaction equations.
		10th	Properties and classification of elements. Hydrogen, noble gases.	1. Explain the properties and classification of elements. 2. Explain the properties of hydrogen and noble gases and solve problems.
		11th	Alkali metals and alkaline earth metals. Boron and elements of group 13.	Explain the properties of alkali metals and alkaline earth metals, boron and elements of group 13 and solve problems.
		12th	Carbon and elements of group 14. Nitrogen and elements of group 15.	Explain and solve problems on the properties of carbon and elements of group 14, nitrogen and elements of group 15.
		13th	Oxygen and halogens.	Explain the properties of oxygen and halogens and solve problems.
		14th	Zinc and group 12 elements. Rare earth and actinide elements	Explain the properties of zinc and group 12 elements and solve problems. Can explain the properties of rare earth and actinide elements and solve problems.
		15th	final exam	
		16th	Return of Final Exam Answer Sheet	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	0	30	100
Basic Proficiency	50	0	0	0	0	20	70
Specialized Proficiency	20	0	0	0	0	10	30
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Advanced Inorganic Chemistry
Course Information						
Course Code	1414B11			Course Category	Specialized / Compulsory	
Class Format	Lecture			Credits	Academic Credit: 2	
Department	Course of Chemical Engineering			Student Grade	4th	
Term	Second Semester			Classes per Week	後期:2	
Textbook and/or Teaching Materials	Exercises in Inorganic Chemistry: From the Basics to the Graduate School Entrance Examination, 2nd Edition (Tokyo Kagaku Doujin)					
Instructor	Zheng Tao					
Course Objectives						
The goal is to understand the structure and properties of various inorganic compounds (metals, ionic compounds, and metal complexes) and to solve exercises. To achieve this goal, the following elements will be accomplished. The student should be able to understand the periodicity of the elements and be able to understand the structure of the nucleus and the state of the outer electrons of the nucleus. Students should be able to understand the electron configuration of atoms. Students should be able to understand molecular orbitals as they relate to chemical bonding.						
Rubric						
	Ideal Level		Standard Level		Minimum Level	
Objective 1	To be able to solve exercises on atomic structure		Solve example problems related to atomic structure.		Explain the structure of atoms.	
Objective 2	To be able to solve exercises on chemical bonding		To solve example problems related to chemical bonding		Explain chemical bonding. Explain the structure of solids.	
Objective 3	To be able to solve exercises on the structure of solids		Students will be able to solve example problems related to the structure of solids.		To be able to explain the structure of solids.	
Objective 4	To be able to solve exercises on acids and bases		To solve example problems related to acids and bases		To explain about acids and bases	
Objective 5	To be able to solve exercises on complexes		To solve example problems related to complexes		Explain complexes.	
Assigned Department Objectives						
Teaching Method						
Outline	This course is designed to prepare students for university transfer examinations and to enable them to solve inorganic chemistry exercises at the first and second year university level. This course focuses on the content of "Inorganic Chemistry 1" taken in the third year and "Inorganic Chemistry 2" taken in the fourth year, as well as exercises in the areas frequently used in transfer examinations. This course is a lecture-style course on inorganic chemistry taught by faculty members who were in charge of research and development of inorganic materials such as electrode materials at companies, making use of their experience.					
Style	After lectures on each unit, problems will be explained. A self-study assignment will be given each week. The assignments will consist of similar problems from that week, as well as confirmation of the basic points covered in preparation for the next week's lesson.					
Notice	Students should review "Inorganic Chemistry 1" taken in the third year and "Inorganic Chemistry 2" taken in the fourth year. Reference books Schreiber's Inorganic Chemistry (upper and lower), Tokyo Kagaku Doujin					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester	3rd Quarter	1st	Molecular Symmetry	Explain symmetry operations and symmetry elements.		
		2nd	Molecular Point Groups	Explain point groups of molecules.		
		3rd	Atomic Structures (1)	Draw an outline of atomic orbitals. Organic Chemistry		
		4th	Structure of Atoms (2)	1. Explain the electronic configuration of atoms 2. Explain shielding and penetration and effective nuclear charge.		
		5th	Chemical Bonding (1)	1. Explain Lewis structures and resonance structures 2. Explain the approximate shape of a molecule by VSEPR theory. 3. Explain the polarity of a molecule.		
		6th	Chemical Bonding (2)	1. Explain interatomic potentials and bond lengths 2. Explain the types of hybridized orbitals and molecular geometry 3. Explain hybridized orbitals in molecules		
		7th	Chemical Bonding (3)	1. Explain the energy level diagram of molecular orbitals. 2. Explain the electron configuration of molecular orbitals and calculate bond orders. 3. Explain physical properties from the electron configuration of molecular orbitals.		

		8th	Mid-term exam	
	4th Quarter	9th	Structure of Solids (1)	1. Explain the crystal lattice 2. Explain density, coordination number, and space-filling ratio from crystal structure
		10th	Structure of Solids (2)	1. Explain madelung constant and lattice energy 2. Explain the Born-Haber cycle
		11th	Acids and Bases	1. Identify acids and bases in reaction equations. 2. Explain the strength of acids and bases and the HSAB law.
		12th	Redox	1. Write reaction equations for oxidation-reduction reactions.
		13th	Complex Chemistry (1)	1. Explain the structure of complexes and isomers of complexes 2. Explain the crystal field theory
		14th	Chemistry of Complexes (2)	1. Explain the spectrochemical series 2. Explain the low-spin and high-spin complexes 3. Explain the Jahn-Teller effect
		15th	Elements	1. Explain the properties and reactions of elements and compounds of each group
		16th	Return of final exam papers	

Evaluation Method and Weight (%)

	Examination	Quiz	Portfolio	Presentation and Attitude	Other	Total
Subtotal	60	0	0	0	40	100
Basic Proficiency	40	0	0	0	20	60
Specialized Proficiency	20	0	0	0	20	40
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Physical Chemistry 2	
Course Information							
Course Code		1414D04		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade		4th	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		教科書：福地賢治編 Professional Engineering Library 「物理化学」 実教出版					
Instructor		Yoshida Takehito					
Course Objectives							
1. 熱力学の基礎概念と熱力学第1法則を理解し、関連した熱力学的問題を解析的手法で解き、定量的解を得ることができる。また化学への応用として、標準反応熱及び任意温度の反応熱を求めることができる。 2. 熱力学第2法則、エントロピー、熱力学基本法則から、断熱系ではエントロピー増大の方向に状態変化することを理解する。ギブスエネルギーとヘルムホルツエネルギーを用いて、状態変化の方向と平衡条件を表現できる。 3. 相平衡と溶液に熱力学的手法を取り入れることで、これらの性質を解析的手法で導き、定量的解を得ることができる。							
Rubric							
		理想的な到達レベルの目安		標準的な到達レベルの目安		最低限の到達レベルの目安(可)	
評価項目1		熱力学の基礎概念と熱力学第1法則を理解し、関連した熱力学的問題を解析的手法で解き、定量的解を得ることができる。また化学への応用として、標準反応熱及び任意温度の反応熱を求めることができる。(参考書レベル)		熱力学の基礎概念と熱力学第1法則を理解し、関連した熱力学的問題を解析的手法で解き、定量的解を得ることができる。また化学への応用として、標準反応熱及び任意温度の反応熱を求めることができる。(指定教科書レベル)		熱力学の基礎概念と熱力学第1法則を理解し、関連した熱力学的問題を解析的手法で解き、定量的解を得ることが一部できる。また化学への応用として、標準反応熱及び任意温度の反応熱を求めることが一部できる。	
評価項目2		熱力学第2法則、エントロピー、熱力学基本法則から、断熱系ではエントロピー増大の方向に状態変化することを理解する。ギブスエネルギーとヘルムホルツエネルギーを用いて、状態変化の方向と平衡条件を表現できる。(参考書レベル)		熱力学第2法則、エントロピー、熱力学基本法則から、断熱系ではエントロピー増大の方向に状態変化することを理解する。ギブスエネルギーとヘルムホルツエネルギーを用いて、状態変化の方向と平衡条件を表現できる。(指定教科書レベル)		熱力学第2法則、エントロピー、熱力学基本法則から、断熱系ではエントロピー増大の方向に状態変化することを一部理解できる。ギブスエネルギーとヘルムホルツエネルギーを用いて、状態変化の方向と平衡条件を一部表現できる。	
評価項目3		相平衡と溶液に熱力学的手法を取り入れることで、これらの性質を解析的手法で導き、定量的解を得ることができる。(参考書レベル)		相平衡と溶液に熱力学的手法を取り入れることで、これらの性質を解析的手法で導き、定量的解を得ることができる。(指定教科書レベル)		相平衡と溶液に熱力学的手法を取り入れることで、これらの性質を解析的手法で導き、定量的解を得ることが一部できる。	
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline		本講義は、化学分野の基礎となる物理化学の中で、19世紀に確立した熱力学について、数学的手段を強化して一貫した理論体系として把握する。次に化学への重要な応用として、相平衡と溶液を熱力学の観点から数理的に理解することを学ぶ。演習問題を多く取り入れることで問題解決能力を養い、応用化学分野への適応能力を身につける。この科目は企業で、半導体集積素子の設計及び製造プロセスの研究・開発を担当していた教員が、その経験を活かし、化学熱力学について講義形式で授業を行うものである。					
Style		授業内容は授業計画を参照すること。基本的に講義形式をとる。板書が主体であるが、関連資料のスライド紹介も取り入れる。学生への発問はするので(3-5回/1コマ)、積極的に答えること。指名されない学生も積極的に考えること。計15回(計約60問)の課題は、自主的に考えて解き問題解決の力を養うこと。					
Notice		3年生までの数学・物理・化学系科目の知識を前提として活用するので、これらの内容をしっかり復習しておくこと。また授業各回毎に出された課題の実施を含む自学自習が不可欠である。授業時間内に自学自習課題の解説を十分に行うことは不可能なので、疑問点があれば質問に来ること。質問にあたっては、先ず自分で調べ考えてみて、何が理解できなかったのかをはっきりさせてから質問に来ること。 シラバス指定参考書：千原・稲葉訳「アトキンス 基礎物理化学－分子論的アプローチ－(下)」第2版 東京化学同人					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input checked="" type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
				Theme		Goals	
1st Semester r	1st Quarter	1st	熱力学の基礎概念		熱力学に必要な基礎概念(SI単位系、圧力、熱容量・比熱、熱、仕事、内部エネルギー等を理解し、換算などの簡単な計算ができる。		
		2nd	熱力学第1法則：熱力学第1法則		第1法則とその基となる各種過程(準静的、可逆・不可逆)について説明でき、和差による各種計算に活用できる。		
		3rd	熱力学第1法則：各種変化		各種(定積・定圧・等温・断熱)変化における内部エネルギー・エンタルピー・仕事などの計算ができ、断熱変化においては、マイヤーの関係式・ポアッソンの式を理解し活用できる。		
		4th	熱力学第1法則：反応熱		標準生成熱から標準反応熱を計算し、キルヒホッフの式を用いて任意の温度の反応熱が計算できる。		
		5th	熱力学第2法則：		第2法則を定性的に理解し説明できる。カルノーサイクルの動作を理解し、作業物質を理想気体とした場合の効率を計算できる。		
		6th	熱力学第2法則：		第2法則(熱比の式)から状態量であるエントロピーの存在を導出できる。膨張・温度変化など各種変化のエントロピー計算ができる。		

		7th	熱力学第 2 法則：	熱力学ポテンシャル（ギブスエネルギー、ヘルムホルツエネルギー）を用いて、等温・等圧変化、等温・等積変化の方向あるいは平衡状態を説明することができる。
		8th	中間試験	
	2nd Quarter	9th	熱力学第 2 法則：	マックスウェルの関係式を理解し、熱力学的状態量（独立、従属）間の関係を導くことができる。またギブス-ヘルムホルツの式を導出できる（平衡定数温度依存性の基礎）。
		10th	熱力学第 3 法則：	第 3 法則に基づいて標準エントロピーについて説明できる。簡単な化学反応におけるエントロピー変化（任意温度）を計算することができる。
		11th	相平衡：	相転移・相平衡について理解し、ギブスの相律を活用することができる。純物質の状態図を理解し、クラウジウス-クラペイロンの式を理解・活用して、圧力変化と相転移温度の関係を導ける。
		12th	相平衡と溶液：	2 成分系の気-液平衡条件を理解し、ラウールの法則から理想溶液の蒸気圧を計算できる。
		13th	相平衡と溶液：	ヘンリーの法則から理想希薄溶液の蒸気圧・液体のガス吸収を計算できる。
		14th	相平衡と溶液：	活量の定義から実在溶液の蒸気圧・沸点を算出できる。
		15th	相平衡と溶液：	束一的性質を理解し、沸点上昇、凝固点降下、浸透圧に関係する計算ができる。
		16th	期末試験答案返却・解答解説	

Evaluation Method and Weight (%)

	定期試験	小テスト	ポートフォリオ	発表・取り組み姿勢	課題・レポート	Total
Subtotal	60	0	0	0	40	100
基礎的能力	20	0	0	0	10	30
専門的能力	30	0	0	0	20	50
分野横断的能力	10	0	0	0	10	20

Anan College		Year	2024		Course Title	Physical Chemistry 3	
Course Information							
Course Code	1414D11			Course Category	Specialized / Compulsory		
Class Format	Lecture			Credits	Academic Credit: 2		
Department	Course of Chemical Engineering			Student Grade	4th		
Term	Second Semester			Classes per Week	後期:2		
Textbook and/or Teaching Materials	Textbook: Professional Engineering Library Butsurikagaku, Fukuchi (Zikkyosyuppan)						
Instructor	Nakamura Atsunobu						
Course Objectives							
1. Understand electrical conduction phenomena of electrolyte solutions. 2. Understand the behavior of ions in electric fields and the ionization equilibrium. 3. Understand redox reactions that occur at battery electrodes 4. Understand the standard electrode potential and the electromotive force.							
Rubric							
	Ideal Level			Standard Level		Minimum Level	
Achievement 1	Explain electrical conduction phenomenon of aqueous electrolyte solutions and perform related calculations.			Explain an electrical conductivity for aqueous electrolyte solutions.		Calculate an electrical conductivity of aqueous electrolyte solution.	
Achievement 2	Explain the behavior of ions in electric fields and ionization equilibrium, and perform related calculations.			Explain the behavior of ions in an electric field and the ionization equilibrium.		Calculate ionization equilibrium constants.	
Achievement 3	Explain redox reactions that occur at battery electrodes, and perform related calculations.			Explain redox reactions that occur at battery electrodes.		Determine the change in oxidation number for redox reactions that occur at battery electrodes.	
Achievement 4	Explain the standard electrode potential and the electromotive force, and perform related calculations.			Explain the standard electrode potential and the electromotive force.		Calculate an electromotive force from a standard electrode potential.	
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline	Electrochemistry considers electrical phenomena in chemical changes. This field has been applied to various fields such as batteries and energy conversion. In this lecture, the basics of electrochemistry will be explained with exercises.						
Style	Lectures will be given according to the textbook, but the missing parts will be supplemented with exercises. We will solve exercises as much as possible during class, but if there is no time, solve them yourself. There will be quizzes at the end of each unit, so please review thoroughly in advance.						
Notice	The knowledge about redox reactions and electrolysis learned in the lower grades of chemistry will be used as the basis for this class, so be sure to review it thoroughly in advance. Reference book: Ippankagaku, Atkins (Tokyokagakudouzin)						
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester r	3rd Quarter	1st	Ionization of electrolytes		Calculate the degree of ionization in electrolytes.		
		2nd	Electrical conductivity of ions		Calculate molar conductivity.		
		3rd	Ion mobility and transport number		Calculate ion transport numbers.		
		4th	Arrhenius theory of ionization		Understand Arrhenius theory of ionization.		
		5th	Activity coefficients in electrolyte solutions		Express physical quantities using Activity coefficients.		
		6th	Ionic strength		Calculate values of ionic strength.		
		7th	Ionization equilibria of acids and bases		Calculate ionization constants.		
		8th	Midterm exam				
	4th Quarter	9th	Basics of battery		Write chemical equations for half-cells.		
		10th	Redox reaction 1		Calculate oxidation numbers and write simple redox equations.		
		11th	Redox reaction 2		Derive redox equations.		
		12th	Gibbs free energy and electromotive force		Calculate electromotive forces and equilibrium constants of sparingly soluble salts.		
		13th	Battery and electrolysis		Understand the mechanism of practical batteries and perform calculations related to electrolysis.		
		14th	Colloid		Calculate the motion of colloidal particles.		
		15th	Surface tension and adsorption		Solve problems related to surface tension, and understand the characteristics of adsorption isotherms.		

		16th	Final exam			
Evaluation Method and Weight (%)						
	Examination	Quiz	Portfolio	Presentation/Attitude	Other	Total
Subtotal	60	10	30	0	0	100
Basic Proficiency	20	0	10	0	0	30
Specialized Proficiency	40	10	20	0	0	70
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Biochemistry 2
Course Information					
Course Code	1414G02		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Chemical Engineering		Student Grade	4th	
Term	Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials	Fundamentals of General, Organic and Biological Chemistry, 8th Edition				
Instructor	Otani Takashi				
Course Objectives					
1. Understand chemical concepts related to biological functions. 2. Understand the chemical concepts of substances that make up living things. 3. Understand chemical reactions in living organisms.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	Explain chemical concepts related to biological functions in detail by giving examples.		Explain chemical concepts related to biological functions by giving examples.		Not explain chemical concepts related to biological functions by giving examples
Achievement 2	Explain in detail the chemical concepts of substances that make up living things, giving examples.		Explain the chemical concepts of substances that make up living things, giving examples.		Not explain the chemical concepts of substances that make up living things, giving examples.
Achievement 3	Explain chemical reactions in living organisms in detail using examples.		Explain chemical reactions in living organisms using examples.		Not explain chemical reactions in living organisms using examples.
Assigned Department Objectives					
学習・教育到達度目標 D-1					
Teaching Method					
Outline	This course focuses on 1) metabolism of glucose, lipid, and protein, 2) Nucleic acids and protein synthesis.				
Style	Face-to-face lecture				
Notice					
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class <input type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
2nd Semester r	3rd Quarter	1st	Glycolysis, the fate of pyruvate	Describe the glycolysis pathway and its products.	
		2nd	The citric acid cycle	Describe the reactions in the citric acid cycle and explain its role in energy production.	
		3rd	The electron-transport chain and ATP production	Describe the electron-transport chain, oxidative phosphorylation, and how the two-processes are coupled.	
		4th	Regulation of glucose metabolism and metabolism during stress	Identify the hormones that influence glucose metabolism and describe the changes in metabolism during stress conditions	
		5th	Gluconeogenesis	Explain the pathways for synthesis of glucose from noncarbohydrate molecules.	
		6th	Lipids 1	Describe the chemical structures and general properties of fatty acids. Recognize phospholipids and glycolipids and describe their functions.	
		7th	Lipids 2	Identify the membrane lipids and describe their structures and rolls. Distinguish between passive transport and active transport and between simple diffusion and facilitated diffusion.	
		8th	Midterm exam		
	4th Quarter	9th	Lipid metabolism 1	Name the major classes of lipoproteins, specify the nature and function of the lipids they transport, and identify their destinations.	
		10th	Lipid metabolism 2	Name the major pathway for the synthesis and breakdown of triacylglycerols and fatty acids, and identify their connections to other metabolic pathways. Describe fatty acid oxidation.	
		11th	Protein and amino acid metabolism 1	List the steps of protein digestion. Explain how amino acids are catabolized and describe the fate oh the nitrogen of an amino acid.	
		12th	Protein and amino acid metabolism 2	Identify the major reactants and products of the urea cycle. Describe the metabolic fate of the carbon atoms in an amino acid.	
		13th	Nucleic acids and protein synthesis 1	Describe, identify, and draw the components of nucleosides and nucleotides. Describe and identify nucleic acid chains in DNA and RNA.	

		14th	Nucleic acids and protein synthesis 2	Interpret the structures of DNA, and write complementary sequences. Explain the process of DNA replication.
		15th	Nucleic acids and protein synthesis 3	Explain the process of transcription, and write complementary strands through mRNA. Identify the initiation, elongation, and termination steps in translation for protein synthesis.
		16th		

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	30	0	100
Basic Proficiency	50	0	0	0	15	0	65
Specialized Proficiency	20	0	0	0	15	0	35
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Biochemistry1	
Course Information							
Course Code	1414G03			Course Category	Specialized / Compulsory		
Class Format	Lecture			Credits	Academic Credit: 2		
Department	Course of Chemical Engineering			Student Grade	4th		
Term	First Semester			Classes per Week	前期:2		
Textbook and/or Teaching Materials	Fundamentals of General, Organic and Biological Chemistry, 8th Edition						
Instructor	Otani Takashi						
Course Objectives							
Rubric							
		Ideal Level	Standard Level		Unacceptable Level		
Achievement 1		Describe the different functions of proteins precisely and give an example for each function.	Describe the different functions of proteins and give an example for each function.		Describe the different functions of proteins and not give an example for each function.		
Achievement 2		Describe the function of enzymes and vitamins in biochemical reactions precisely.	Describe the function of enzymes and vitamins in biochemical reactions.		Not describe the function of enzymes and vitamins in biochemical reactions.		
Achievement 3		Classify carbohydrates into three subtypes: monosaccharides, disaccharides, and polysaccharides, describe structure and function of carbohydrates precisely.	Classify carbohydrates into three subtypes: monosaccharides, disaccharides, and polysaccharides, describe structure and function of carbohydrates.		Not classify carbohydrates into three subtypes: monosaccharides, disaccharides, and polysaccharides, describe structure and function of carbohydrates precisely.		
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline	This course focuses on functions of proteins, enzymes, vitamins, and carbohydrates.						
Style	Face-to-face lecture						
Notice							
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Amino acids and proteins 1		Functions of proteins		
		2nd	Amino acids and proteins 2		Amino acids		
		3rd	Amino acids and proteins 3		Chirality and structure of amino acids		
		4th	Amino acids and proteins 4		Primary and secondary protein structure		
		5th	Amino acids and proteins 5		Tertiary and quaternary protein structure		
		6th	Enzymes and vitamins 1		Catalysis by enymes		
		7th	Enzymes and vitamins 2		How Enzymes work		
		8th	Enzymes and vitamins		Vitamins		
	2nd Quarter	9th	Midterm exam				
		10th	Carbohydrates 1		Monosaccharides 1		
		11th	Carbohydrates 2		Monosaccharides 2		
		12th	Carbohydrates 3		Disaccharides		
		13th	Carbohydrates 4		Polysaccharides		
		14th	The generation of biochemical energy 1		Energy, life, and biochemical reactions		
		15th	The generation of biochemical energy 2		Strategy of metabolism		
		16th					
Evaluation Method and Weight (%)							
	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	30	0	100
Basic Proficiency	40	0	0	0	20	0	60
Specialized Proficiency	20	0	0	0	10	0	30
Cross Area Proficiency	10	0	0	0	0	0	10

Anan College		Year	2024		Course Title	Experiments in Advanced Chemistry Laboratory	
Course Information							
Course Code	1414T07		Course Category		Specialized / Compulsory		
Class Format	Experiment / Practical training		Credits		Academic Credit: 2		
Department	Course of Chemical Engineering		Student Grade		4th		
Term	Second Semester		Classes per Week		後期:4		
Textbook and/or Teaching Materials							
Instructor	Nakamura Atsunobu,Ota Naotomo,Konishi Tomoya,Zheng Tao,Otani Takashi,Ueda Kohei,Ezure Ryosuke,Sugiyama Yuuki						
Course Objectives							
Rubric							
	Ideal Level		Standard Level		MinimumLevel		
Achievement 1							
Achievement 2							
Achievement 3							
Achievement 4							
Assigned Department Objectives							
学習・教育到達度目標 D-2 学習・教育到達度目標 D-4 学習・教育到達度目標 E-2							
Teaching Method							
Outline							
Style							
Notice							
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester	3rd Quarter	1st					
		2nd					
		3rd					
		4th					
		5th					
		6th					
		7th					
		8th					
	4th Quarter	9th					
		10th					
		11th					
		12th					
		13th					
		14th					
		15th					
		16th					
Evaluation Method and Weight (%)							
	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	0	0	0	0	0	0
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Chemical Engineering 2	
Course Information							
Course Code		1414T09		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade		4th	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		ベーシック化学工学（化学同人）橋本健治著					
Instructor		Ezure Ryosuke					
Course Objectives							
1. 熱の流れの基礎を学んで、熱交換に必要な伝熱面積の算出ができる。 2. 抽出と分離の基礎を学んで、抽出・分離の技術が理解でき、説明できる。							
Rubric							
		理想的な到達レベルの目安		標準的な到達レベルの目安		未到達レベルの目安(可)	
到達目標1		熱の流れの物理法則を理解し、熱交換器の設計のための計算ができる。		熱の流れの物理法則を理解し、伝熱の基本的な計算ができる。		熱の流れの物理法則を理解できる。	
到達目標		液液平衡の原理を理解し、抽出装置の設計のための計算ができる。きる。		液液平衡の原理を理解し、基本的な計算ができる。		液液平衡の原理を理解している。	
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline		化学工学は、化学プラントの運転と設計を扱う学問です。4年生の化学工学2では、最初に、伝熱の基礎、次に、抽出操作を学びます。					
Style		講義の最後に宿題を与えます。宿題をすることが復習と予習につながります。授業中に練習問題を課しますので、講義には電卓を忘れないように持ってきてください。					
Notice		不明な点は授業中に質問してください。 課題の提出状況も評価に入ります。 テスト問題作成後は質問は一切受け付けられません。					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
1st Semester	1st Quarter		Theme	Goals			
		1st	熱交換器の基礎とその構造	ボイラー、蒸発缶などの熱交換器の構造が理解できる。			
		2nd	熱伝導 1	フーリエの法則と熱伝導度を理解できる。			
		3rd	熱伝導 2	様々な形状の固体の中の熱の伝わり方を理解し、計算ができる。			
		4th	対流熱伝達 1	熱伝達と熱伝導の違いを理解し、総括伝熱係数を計算できる。			
		5th	対流熱伝達 2	ヌッセル数、プラントル数および境膜伝熱係数の計算ができる。			
		6th	熱放射	赤外線が空間を飛び越えて熱を伝える熱放射を理解し、放射熱の吸収率が計算できる。			
		7th	熱交換器の設計	二重管式熱交換器のエネルギー収支を理解して、伝熱面積が計算できる。			
	2nd Quarter	8th	中間試験				
		9th	抽出の原理と装置	抽出の工業的な意義が理解できる。			
		10th	液液平衡関係 1	三角線図により混合液の状態が表現できる。			
		11th	液液平衡関係 2	てこの原理が理解できる。			
		12th	溶解度曲線	3成分の混合液の溶解度曲線を三角線図上に作図できる。			
		13th	単抽出の計算	単抽出による溶質の回収率が計算できる。			
		14th	多回抽出の計算	多回抽出による溶質の回収率が計算できる。			
		15th	吸着や膜分離の基礎	吸着や膜分離の原理・目的・方法を理解できる。			
16th	期末試験・試験返却						
Evaluation Method and Weight (%)							
	定期試験	課題				Total	
Subtotal	70	30	0	0	0	100	
基礎的能力	0	0	0	0	0	0	
専門的能力	70	30	0	0	0	100	
分野横断的能力	0	0	0	0	0	0	

Anan College		Year	2024		Course Title	Experiments and Exercises in Materials Chemistry 3	
Course Information							
Course Code		1414T12		Course Category		Specialized / Compulsory	
Class Format		Experiment / Practical training		Credits		Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade		4th	
Term		First Semester		Classes per Week		前期:4	
Textbook and/or Teaching Materials		Distribute resumes and textbooks					
Instructor		Nakamura Atsunobu,Konishi Tomoya,Ota Naotomo,Otani Takashi,Zheng Tao,Ueda Kohei,Sugiyama Yuuki,Ezure Ryosuke					
Course Objectives							
To master the process of problem solving in research by conducting experiments (investigations) related to the research theme in each laboratory. To recognize the fundamental difference between "student experiments" and "graduation research".							
Rubric							
		Ideal Level		Standard Level		minimum Level	
Achievement 1		Can discover problems to be solved in the research theme by himself/herself.		Be able to explain the problems to be solved in the research theme.		To be able to explain to the supervisor the problems to be solved in the research theme.	
Achievement 2		Able to propose his/her own solutions to problems in the research theme.		Be able to explain how to solve problems in the research theme.		To be able to explain to the supervisor how to solve problems in the research theme.	
Achievement 3		To be able to carry out experiments (investigations) on how to solve problems with an understanding of the meaning and significance of the experiments (investigations).		To be able to carry out experiments (investigations) on how to solve problems.		To be able to conduct experiments (investigations) on how to solve problems with assistance.	
Achievement 4		To be able to explain one's own considerations about the results of an experiment (survey).		Be able to explain the results of the experiments (investigations) conducted.		To be able to explain the results of the experiment (investigation) to the supervisor.	
Assigned Department Objectives							
学習・教育到達度目標 D-2 学習・教育到達度目標 D-4 学習・教育到達度目標 E-1							
Teaching Method							
Outline		Students will be divided into small groups of 4-5 students and will perform biochemical experiments for the first four sessions. Thereafter, students will visit all laboratories in the chemistry course on a weekly basis. By working on the experiments or investigations presented in each laboratory, students will learn the guidelines for the laboratory they wish to belong to and the research themes they wish to work on, as well as the methods (thinking and approaches for identifying and solving problems) necessary for conducting their graduation research. In the fourth semester of this course, the faculty members who were in charge of research and development of the design and manufacturing process of semiconductor integrated devices at a company use their experience to teach material chemistry in an experimental format.					
		Translated with www.DeepL.com/Translator (free version)					
Style		Students are required to study the contents and process of the experiments in advance by reading the resumes distributed to them, and to conduct experiments or investigations related to the theme of their graduation research in each laboratory. After completing the experiment or investigation, students will submit a report and take a quiz on the content of the experiment or investigation. 60 hours of class time + 30 hours of self-study					
		Translated with www.DeepL.com/Translator (free version)					
Notice		1. safety instructions will be given at the beginning of each session, so please be at the location indicated on your resume by the start time. 2. Wear appropriate clothing, footwear and protective equipment for each experiment or investigation (see resume for details). 3) Carry the necessary items for each experiment or investigation (see resume for details). 3. carry the necessary items for each experiment or investigation (see resume for details). 4. follow the instructions and precautions of your instructor. 5. reports must be submitted within one week after the completion of the experiment (investigation).					
		Translated with www.DeepL.com/Translator (free version)					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Experimental Guidance		Be able to explain the safety measures to be taken during experiments and the content of future experiments.		
		2nd	DNA and protein extraction		DNA and proteins can be extracted.		
		3rd	restriction endonuclease		DNA can be separated by electrophoresis after restriction enzyme treatment.		
		4th	Protein activity measurement		Can measure protein activity		
		5th	Sintering of translucent alumina ceramics		Be able to explain the meaning of each experiment (investigation) and conduct it safely.		

		6th	Survey of distribution of alien species - dandelion survey	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		7th	Preparation and evaluation of ceramic phosphors	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		8th	Synthesis and Evaluation of Lithium Titanate Nanoparticles	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
	2nd Quarter	9th	Optical resolution of mandelic acid	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		10th	Substance Separation and Component Analysis	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		11th	Conduct experiments (surveys) related to the graduation research theme of each laboratory	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		12th	Conduct experiments (surveys) related to the graduation research theme of each laboratory	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		13th	Conduct experiments (surveys) related to the graduation research theme of each laboratory	Be able to explain the meaning of each experiment (investigation) and conduct it safely.
		14th	Presentation and examination of the contents of the experiment (survey)	Describe the results of experiments (surveys) that have been conducted and explain how they have led to solutions to problems.
		15th	Learning about research and development in companies and research institutions	Explain problem finding and problem solving in practice.
		16th		

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	0	0	0	100	0	100
Basic Proficiency	0	0	0	0	50	0	50
Specialized Proficiency	0	0	0	0	50	0	50
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Information Processing
Course Information						
Course Code	1494001			Course Category	Specialized / Elective	
Class Format	Lecture			Credits	Academic Credit: 2	
Department	Course of Chemical Engineering			Student Grade	4th	
Term	Second Semester			Classes per Week	後期:2	
Textbook and/or Teaching Materials	Yasashikumanaberu C gengo - ANSI Kikakuzyunkyo, Fukuda (Morikita Syuppan)					
Instructor	Nakamura Atsunobu					
Course Objectives						
1. Understand basic C language grammar. 2. Understand basic algorithms and be able to create C language programs. 3. Understand arithmetic functions and be able to create programs. 4. Create a C language program with input/output to a data file.						
Rubric						
	Ideal Level		Standard Level		Minimum Level	
Achievement 1	Understand the grammar of the C language, and be able to correct and explain grammatical errors in programs.		Understand the basic grammar of the C language, and be able to correct grammatical errors in programs.		Understand the basic grammar of the C language, and be able to correct grammatical errors in simple programs.	
Achievement 2	Understand basic C language programs and create programs according to algorithms.		Understand basic C language programs and create simple programs.		Understand basic C language programs to some extent and can create simple programs.	
Achievement 3	Create programs using arithmetic functions and user-defined functions.		Create simple programs using arithmetic functions and user-defined functions.		Create simple programs using arithmetic functions.	
Achievement 4	Understand the input/output of data files and create C language programs using them.		Create a simple C language program with input/output to a data file.		Write a simple C language program with output to a data file.	
Assigned Department Objectives						
学習・教育到達度目標 B-4 学習・教育到達度目標 D-1 学習・教育到達度目標 D-3						
Teaching Method						
Outline	Various theoretical formulas and equations that appear in chemistry subjects often contain multiple parameters and have complex forms. It is difficult to perform the calculation only with a calculator. The goal of this class is to (1) understand the basic grammar of the C language, which is one of the programming languages, and (2) be able to create simple programs. For this purpose, students will learn the basic C language grammar related to programming through examples and exercises. This course will be taught by a faculty member who was in charge of semiconductor development at a company.					
Style	In this class, lectures and exercises on C language grammar will be conducted using a personal computer. There will be assignments for each lecture, so be sure to submit them.					
Notice	I would like students to actively try to master the C language by solving the assignments using computers in the seminar room or the library.					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester r	3rd Quarter	1st	Environmental setting, binary and hexadecimal	Convert between binary, decimal and hexadecimal numbers		
		2nd	Basic operations for programming	Understand program entry, error handling, and debugging procedures		
		3rd	Data types and declarations	Understand data types and declarations, how to initialize and assign variables		
		4th	Standard output	Use the standard output function		
		5th	Standard input and operators	Use standard output functions and basic operators		
		6th	Repeat sentence 1	Use if statements and switch statements		
		7th	Repeat sentence 2	Use for statements		
		8th	Midterm exam			
	4th Quarter	9th	Pointers and structures	Use pointers		
		10th	File processing	Understand the procedure for inputting and outputting data to files		
		11th	Arrays	Understand array types, declarations, and initializations		
		12th	Applications of arrays	Make programs for inner and outer products of vectors		
		13th	Function	Use arithmetic functions and understand how to create functions		
		14th	Applications of repeat sentences	Make a numerical differentiation program and an integration program		

		15th	Application example	Make programs using Newton's method and finite difference method		
		16th	Final exam			
Evaluation Method and Weight (%)						
	Examination	Quiz	Portfolio	Presentation/Attitude	Other	Total
Subtotal	50	0	50	0	0	100
Basic Proficiency	10	0	10	0	0	20
Specialized Proficiency	30	0	30	0	0	60
Cross Area Proficiency	10	0	10	0	0	20

Anan College		Year	2024	Course Title	Environmental Engineering
Course Information					
Course Code	1494F03		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Chemical Engineering		Student Grade	4th	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	Official Textbook for the 9th Revised Edition of the eco Test for Environmental Society, Tokyo Chamber of Commerce and Industry, JMA Management Center, Inc.				
Instructor	Ota Naotomo				
Course Objectives					
1. Understand sustainability and explain the history of environmental issues. 2. Explain the physical, chemical, and biological characteristics of the earth and the current status and issues in society related to the environment. 3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation. 4. To be able to explain the current status and issues of basic principles, plans, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment in environmental conservation. Understand and explain the collaboration among government, business, and citizens in environmental conservation and the roles of each.					
Rubric					
		Ideal Level	Standard Level	minimum Level	
Achievement 1		Understand sustainability and be able to explain the history of environmental issues in detail.	Understand sustainability and be able to explain the history of environmental issues.	Understand sustainability and the history of environmental issues.	
Achievement 2		To be able to explain in detail the physical, chemical and biological characteristics of the earth and the current status and issues of society regarding the environment.	To be able to explain the physical, chemical and biological characteristics of the earth and the current status and issues of society regarding the environment.	To be able to understand the physical, chemical and biological characteristics of the earth and the current status and issues of society regarding the environment.	
Achievement 3		To be able to explain in detail about global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.	To be able to explain about global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.	To be able to understand about global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.	
Achievement 4		To be able to explain in detail the current status and issues regarding basic principles, planning, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment.	To be able to explain the current status and issues regarding basic principles, planning, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment.	To be able to understand the current status and issues regarding basic principles, planning, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment.	
Achievement 5		Understand and be able to explain in detail the collaboration among government, business, and citizens in environmental conservation and the roles of each.	Understand and be able to explain the collaboration among government, business, and citizens in environmental conservation and the roles of each.	Understand the collaboration among government, business, and citizens in environmental conservation and the roles of each.	
Assigned Department Objectives					
学習・教育到達度目標 A-3 学習・教育到達度目標 D-1 学習・教育到達度目標 D-4					
Teaching Method					
Outline	Acquire a broad knowledge of the entire environmental field with the aim of becoming a human resource capable of leading a "sustainable society" that balances the environment and the economy.				
Style	Students will be evaluated by quizzes, reports, and presentations.				
Notice					
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class	
				<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Guidance		
		2nd	History with Sustainability and Environmental Issues	1. Understand sustainability and explain the history of environmental issues.	
		3rd	Fundamentals of the Earth	2. Explain the physical, chemical, and biological characteristics of the earth and the current status and issues in society related to the environment.	

		4th	Current state of society: population, economy, food, resources, poverty	2. Explain the physical, chemical, and biological characteristics of the earth and the current status and issues in society related to the environment.
		5th	Global Warming	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		6th	Energy Issues	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		7th	Biodiversity and its crisis	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		8th	Global environmental problems	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
	2nd Quarter	9th	Recycling-oriented society	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		10th	Local Environmental Issues	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		11th	Chemical Substances and Radioactivity	3. To be able to explain the current status and issues of global warming, energy problems, biodiversity, recycling-oriented society, chemical substances, radioactivity, and regional and global environmental problems from the viewpoint of environmental conservation.
		12th	Basic principles, plans, environmental standards, and methods of environmental conservation	4. To be able to explain the current status and issues of basic principles, plans, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment in environmental conservation.
		13th	Environmental education, environmental impact assessment	4. To be able to explain the current status and issues of basic principles, plans, environmental standards, environmental conservation methods, environmental education, and environmental impact assessment in environmental conservation.
		14th	Roles of government and business	5. Understand and explain the collaboration among government, business, and citizens in environmental conservation and the roles of each.
		15th	Role of individuals and NPOs	5. Understand and explain the collaboration among government, business, and citizens in environmental conservation and the roles of each.
		16th		

Evaluation Method and Weight (%)

	quiz	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	65	15	0	0	20	0	100
Basic Proficiency	65	15	0	0	20	0	100
Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Internship
Course Information					
Course Code	1494R11		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	School Credit: 1	
Department	Course of Chemical Engineering		Student Grade	4th	
Term	Year-round		Classes per Week	前期:2 後期:2	
Textbook and/or Teaching Materials	NA				
Instructor	Ueda Kohei				
Course Objectives					
1. To be able to explain the manners one should acquire as a member of society. 2. To be able to explain the nature of the work at the training site. 3. To be able to prepare a report on the results of practical training at the training site. 4. To be able to present the results of practical training at the training site.					
Rubric					
	Ideal Level		Standard Level		MinimumLevel
Achievement 1	To be able to explain the manners one should acquire as a member of society, and to be able to learn on one's own initiative.		To be able to explain the manners one should acquire as a member of society.		To be able to explain the manners one should acquire as a member of society.
Achievement 2	To be able to explain about the work content and social responsibility (CSR, SR) of the company where the trainee is practicing.		To be able to explain the nature of the work of the company where the trainee will receive practical training.		To be able to explain the nature of the work of the company where the trainee will receive practical training.
Achievement 3	To be able to prepare a report on the results of practical training at the training site in a logical and orderly manner, with easy-to-understand items such as objectives, etc.		To be able to prepare a report on the results of practical training at the training site.		To be able to prepare a report on the results of practical training at the training site.
Achievement 4	To be able to present the results of practical training at the training site in an easy-to-understand manner using appropriate slides within a timely manner.		To be able to present the results of practical training at the training site.		To be able to present the results of practical training at the training site.
Assigned Department Objectives					
学習・教育到達度目標 A-1 学習・教育到達度目標 A-2 学習・教育到達度目標 A-3 学習・教育到達度目標 B-1					
Teaching Method					
Outline	The objective is to learn the knowledge and abilities required by the host institution through practical training at companies, universities, etc. The program also aims to deepen vocational understanding through an understanding of the work of the host institution and to cultivate a work ethic. The goal is for students to actively acquire the attitude and awareness required to become engineers through practical training experiences, and to broaden their perspectives and personal growth through social experiences.				
Style	After completing the practical training, students are required to submit a report and make a presentation at a debriefing session. Please note that absence from work during the practical training period will be regarded as an abandonment of the course and will not fulfill the acquisition requirements. Students are required to make a plan for transportation to and from work and commuting to and from work during the period of the training. During the training period, students are expected to take good care of their health, pay close attention to tardiness and absenteeism, and work hard every day. Prepare for the practical training by using the Internet and other sources of information.				
Notice					
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class	<input type="checkbox"/> Instructor Professionally Experienced
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Guidance	To be able to explain the significance and contents of off-campus training, and the flow of implementation.	
		2nd	Determination of practical training sites	To be able to decide on a host institution for off-campus training and write a resume and an entry sheet to be submitted to the host institution.	
		3rd	Same as above		
		4th	Same as above		
		5th	Same as above		
		6th	Pre-practicum briefing	To understand and be able to explain general precautions for off-campus training.	

		7th	Implementation of practical training and recording of content	To be able to conduct practical training and training under the guidance of the training site for a period of about 5 days during the summer vacation. To be able to reflect on daily practical training items and summarize the content of practical training in a practical training report (logbook).
		8th	Same as above	
	2nd Quarter	9th	Same as above	
		10th	Same as above	
		11th	Same as above	
		12th	Same as above	
		13th	Same as above	
		14th	Same as above	
		15th	Same as above	
		16th		
2nd Semester	3rd Quarter	1st	Implementation of practical training and recording of content	To be able to conduct practical training and training under the guidance of the training site for a period of about 5 days during the summer vacation. To be able to reflect on daily practical training items and summarize the content of practical training in a practical training report (logbook).
		2nd	Same as above	
		3rd	Same as above	
		4th	Same as above	
		5th	Same as above	
		6th	Same as above	
		7th	Same as above	
		8th	Same as above	
	4th Quarter	9th	Same as above	
		10th	Same as above	
		11th	Same as above	
		12th	Preparation of practical training report	To be able to summarize the outline of the practical training site, the content of the practical training, and what was gained through the practical training in a report of the results of the practical training.
		13th	Same as above	
		14th	Debriefing session on the results of practical training	To be able to present an overview of the training site, the content of the training, and what was gained from the training at the debriefing session on the results of the training.
		15th	Same as above	
		16th		

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	40	0	0	20	40	100
Basic Proficiency	0	10	0	0	10	10	30
Specialized Proficiency	0	30	0	0	5	10	45
Cross Area Proficiency	0	0	0	0	5	20	25

Anan College		Year	2024	Course Title	Probability and Statistics
Course Information					
Course Code	1514A01		Course Category	Specialized / Compulsory	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Chemical Engineering		Student Grade	4th	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	Shin Kakuritsu-tokei Kaiteiban, Dainihon Toshō				
Instructor	Sugino Ryuzaburo				
Course Objectives					
1. We can compute the basic computation of the fundamentals of statistic processes. 2. We can understand basic properties and get the conditional probability and Bay's estimation. 3. We can make a solution of mean value, variance and standard deviation of basic probability distributions.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
Achievement 1	We can compute the basic computation of the fundamentals of statistic processes and apply these for the various problems.		We can compute the basic computation of the fundamentals of statistic processes.		We can compute the basic computation of the elementary statistic processes.
Achievement 2	We can understand basic properties and get the conditional probability and Bay's estimation and apply these for the various problems.		We can understand basic properties and get the conditional probability and Bay's estimation.		We can understand basic properties and get the elementaries of conditional probability and Bay's estimation.
Achievement 3	We can make a solution of mean value, variance and standard deviation of basic probability distributions and apply these for the various problems.		We can make a solution of mean value, variance and standard deviation of basic probability distributions.		We can make a solution of mean value, variance and standard deviation of elementary probability distributions.
Assigned Department Objectives					
学習・教育到達度目標 B-2					
Teaching Method					
Outline	We are to make a concentration for our class and use the knowledges and techniques about undergraduate mathematics to construction of understanding of the probability and statistics.				
Style	Our class is construction of the next three phases. 1. Review the important facts from the previous class. 2. Lecture about the new section. 3. Short exercises.				
Notice	Please make a good preparation and self-review. You will build up the good style to do homework of the previous class. *Mastery of this course is required to complete the Mathematical and Data Science and AI Education Program (Literacy)				
Characteristics of Class / Division in Learning					
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class <input type="checkbox"/> Instructor Professionally Experienced	
Course Plan					
			Theme	Goals	
1st Semester	1st Quarter	1st	Analyzing the data of one-dimensional variable	We can understand and explain of frequency distribution and its measures of center.	
		2nd	Analyzing the data of one-dimensional variable	We can understand and explain of its distribution bias and the dispersion.	
		3rd	Analyzing the data of one-dimensional variable	We can understand and explain of its distribution bias and the dispersion.	
		4th	Analyzing the data of two-dimensional variables	We can understand and explain of its distribution scatter plot bias and the regression line.	
		5th	Analyzing the data of two-dimensional variables	We can understand and explain of its distribution co-variance and the correlation coefficient.	
		6th	Analyzing the data of two-dimensional variables	We can understand and explain of its distribution co-variance and the correlation coefficient.	
		7th	The properties of probability	We can understand and explain of the definition of probability and the number of cases.	
		8th	The properties of probability	We can understand and explain of its probability theorems of the addition and multiplication .	
	2nd Quarter	9th	The properties of probability	We can understand and explain of its probability theorems of the addition and multiplication .	
		10th	Mid-term examination		
		11th	The probability variables and its probability distributions	We can understand and explain of the discrete variables and binomial distribution.	
		12th	The probability variables and its probability distributions	We can understand and explain of the continuous variables and normal distribution.	

		13th	The probability variables and its probability distributions	We can understand and explain of the continuous variables and normal distribution.
		14th	The fundamentals of statistic	We can understand and explain of the statistics and sampling distribution.
		15th	Final examination	
		16th		

Evaluation Method and Weight (%)							
----------------------------------	--	--	--	--	--	--	--

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	60	0	0	0	40	0	100
Basic Proficiency	30	0	0	0	20	0	50
Specialized Proficiency	20	0	0	0	15	0	35
Cross Area Proficiency	10	0	0	0	5	0	15

Anan College		Year	2024		Course Title	Minor
Course Information						
Course Code	1554200			Course Category	Specialized / Elective	
Class Format	Lecture			Credits	Academic Credit: 2	
Department	Course of Chemical Engineering			Student Grade	4th	
Term	First Semester			Classes per Week	前期:2	
Textbook and/or Teaching Materials	Kagakunotamenosuugaku (Syokabo) By Takashi Fujikawa, Kiyotaka Asakura					
Instructor	Ueda Kohei					
Course Objectives						
1. Understand vector analysis, which is essential for learning chemistry and electromagnetism. 2. Understand the properties and calculational methods of complex numbers.						
Rubric						
	Ideal Level			Standard Level		Minimum Level
Achievement 1	Solve practical problems using vector analysis.			Calculate the derivative and integral operations on vectors.		Calculate the basic algebraic operations on vectors.
Achievement 2	Understand the properties and calculations of complex numbers and apply them to chemistry.			Understand the properties and calculational methods of complex numbers.		Understand the properties of complex numbers.
Assigned Department Objectives						
Teaching Method						
Outline	An atom is a particle consisting of a positively charged nucleus surrounded by a cloud of negatively charged electrons. Therefore, in order to understand the behavior of atoms, molecules, and larger systems, it is necessary to understand the electromagnetic interactions between nuclei and electrons. This course deals with chemical mathematics as a preparation for the study of electromagnetism, without being concerned with mathematical rigor.					
Style	Assignments will be given for each lecture. The assignments will help you review and prepare for the lecture. Short exercises will be given during the class.					
Notice	If you have any questions, please ask them in class. No questions will be accepted during the exam period.					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester	1st Quarter	1st	Vector, direction cosine, inner product, cross product	Calculate inner and cross products		
		2nd	Derivatives of vector	Calculate derivatives of vectors		
		3rd	Scalar fields, vector fields	Explain scalar and vector fields		
		4th	Line integral of scalars	Calculate the line integral of scalars		
		5th	Line integral of vector fields	Calculate the line integral of vector fields		
		6th	Surface integral scalars	Calculate the surface integral of scalars		
		7th	Surface integral vector fields	Calculate the surface integral of vector fields		
		8th	Midterm examination			
	2nd Quarter	9th	Basic properties of complex numbers 1	Understand the basic properties of complex numbers		
		10th	Basic properties of complex numbers 2	Understand the basic properties of complex numbers		
		11th	Complex function	Understand the complex function		
		12th	Differentiation of complex functions	Calculate the derivative of complex functions		
		13th	Integral of complex functions	Calculate complex integrals		
		14th	Cauchy's integral theorem	Able to explain Cauchy's integral theorem		
		15th	Cauchy's integral expression	Calculate perimeter integrals using the Cauchy integral expression		
		16th	Final examination			
Evaluation Method and Weight (%)						
	Examination		Portfolio		Total	
Subtotal	50		50		100	
Basic Proficiency	20		15		35	
Specialized Proficiency	15		20		35	
Cross Area Proficiency	15		15		30	

Anan College		Year	2024		Course Title	Research for Graduation Thesis
Course Information						
Course Code	1415000			Course Category	Specialized / Compulsory	
Class Format	Seminar			Credits	School Credit: 10	
Department	Course of Chemical Engineering			Student Grade	5th	
Term	Year-round			Classes per Week	10	
Textbook and/or Teaching Materials	As directed by the faculty advisor.					
Instructor	Nakamura Atsunobu,Yoshida Takehito,Ota Naotomo,Zheng Tao,Otani Takashi,Sugiyama Yuuki,Konishi Tomoya,Ueda Kohei,Ezure Ryosuke					
Course Objectives						
1. To explain the background of the research theme and its significance in engineering and society. 2. To independently conduct research under the guidance of a faculty member in charge in order to plan, conduct experiments, and analyze methods to promote the research theme. 3. To summarize and present the results of research in a graduation thesis with an English abstract.						
Rubric						
	Ideal Level		Standard Level		Unacceptable Level	
Achievement 1	Independently summarize and explain the background, peripheral knowledge, and engineering significance of the research topic.		Explains the background and engineering significance of the research topic under the guidance of the faculty advisor.		Explains the background and engineering significance of the research topic as instructed by the advisor.	
Achievement 2	Examines plans, experimental and analytical methods, etc. to promote the research theme on a proactive basis.		Examines plans and experimental and analytical methods to promote the research theme under the guidance of the faculty advisor.		Promotes the research theme according to the instructions of the advisor.	
Achievement 3	Independently compiles and presents the results of the research in a graduation thesis with an English summary.		Compiles and presents the results of their research in a graduation thesis with English abstract under the guidance of the faculty advisor.		Compiles the results of their research into a graduation thesis with an English abstract as instructed by the advisor.	
Assigned Department Objectives						
学習・教育到達度目標 B-1 学習・教育到達度目標 C-1 学習・教育到達度目標 C-2 学習・教育到達度目標 D-2 学習・教育到達度目標 E-3						
Teaching Method						
Outline	In the process of promoting their research themes, students will acquire the practical skills to solve given problems and issues by applying and utilizing the specialized knowledge they have acquired up to the fourth year. In addition, the goal is to acquire the nurturing skills to be an engineer who can contribute to society. The students concerned in this course (2-4 students) are taught by faculty members who have been in charge of research and development of design and manufacturing processes for semiconductor integrated devices at companies, and who use their experience to conduct classes in a format that combines lectures, exercises, and experiments.					
Style	Students will carry out their research independently in each laboratory under the guidance of the advisor. Two presentations are scheduled: "Interim Presentation," and "Graduation Research Presentation. Students are required to write and submit a graduation thesis.					
Notice	Students must plan well for their assignments and carry out their research independently and continuously.					
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester	1st Quarter	1st	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		2nd	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		3rd	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		4th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		5th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		6th	Theme Presentation	Presents the background of the research topic.		
		7th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		
		8th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.		

2nd Semester	2nd Quarter	9th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		10th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		11th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		12th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		13th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		14th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		15th	Surveys and Research	Investigates the research background, conducts experiments and analysis, and discusses the results.
		16th	midterm (mid-semester) presentation	Presents the results of the research and the issues involved in carrying out the research.
	3rd Quarter	1st	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		2nd	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		3rd	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		4th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		5th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		6th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		7th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		8th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
	4th Quarter	9th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		10th	Conducting Research	Conducts experiments, analyses, etc., and examine and discuss the results.
		11th	Research and Dissertation Writing	Conducts experiments, analyses, etc., and summarizes the results in a paper based on examination and discussion of the results.
		12th	Research and Dissertation Writing	Conducts experiments, analyses, etc., and summarizes the results in a paper based on examination and discussion of the results.
		13th	Research and Dissertation Writing	Conducts experiments, analyses, etc., and summarizes the results in a paper based on examination and discussion of the results.
		14th	Research and Dissertation Writing	Conducts experiments, analyses, etc., and summarizes the results in a paper based on examination and discussion of the results.
		15th	Research and Dissertation Writing	Conducts experiments, analyses, etc., and summarizes the results in a paper based on examination and discussion of the results.
		16th	Graduation Research Presentation	Summarizes the research results in a graduation research paper and presents the outline of the research.

Evaluation Method and Weight (%)

	Presentation / Attitude	Other	Total
Subtotal	50	50	100
Basic Proficiency	0	0	0
Specialized Proficiency	40	30	70
Cross Area Proficiency	10	20	30

Anan College		Year	2024		Course Title	Biotechnology	
Course Information							
Course Code	1415H01			Course Category	Specialized / Compulsory		
Class Format	Lecture			Credits	Academic Credit: 2		
Department	Course of Chemical Engineering			Student Grade	5th		
Term	Second Semester			Classes per Week	後期:2		
Textbook and/or Teaching Materials	Applied Microbiology, Sakai et al. Asakura shoten						
Instructor	Ota Naotomo						
Course Objectives							
1. To be able to explain the types of microorganisms, their characteristics, and methods of cultivating microorganisms. 2. To be able to explain the functions of microorganisms and their application methods.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Achievement 1		1. To be able to explain in detail the types of microorganisms, their characteristics, and methods of cultivating microorganisms.		1. To be able to explain the types of microorganisms, their characteristics, and methods of cultivating microorganisms.		1. To be able to understand the types of microorganisms, their characteristics, and methods of cultivating microorganisms.	
Achievement 2		To be able to explain in detail the functions of microorganisms and their application methods.		To be able to explain the functions of microorganisms and their application methods.		To be able to understand the functions of microorganisms and their application methods.	
Assigned Department Objectives							
学習・教育到達度目標 A-3 学習・教育到達度目標 D-1 学習・教育到達度目標 D-4							
Teaching Method							
Outline	As a basis of biotechnology, learn about the properties and functions of microorganisms, and learn how to handle and use them.						
Style	Grades will be based on quizzes, presentations, and reports. 30 hours of class time + 60 hours of self-study						
Notice							
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme	Goals			
2nd Semester r	3rd Quarter	1st	History of Applied Microbiology	The history of microbiology can be explained			
		2nd	current state of microbiology	Can explain the current state of microbiology			
		3rd	cell structure of microorganisms	Can explain the cell structure of microorganisms			
		4th	genetics of microorganisms	Can explain the genetics of microorganisms			
		5th	regulation of gene expression in microorganisms	Can explain the regulation of gene expression in microorganisms			
		6th	regulation of gene expression in microorganisms	Can explain the regulation of gene expression in microorganisms			
		7th	properties of proteins and enzymes	Can explain the properties of proteins and enzymes			
		8th	metabolism of microorganisms	Can explain the metabolism of microorganisms			
	4th Quarter	9th	metabolism of microorganisms	Can explain the metabolism of microorganisms			
		10th	metabolism of microorganisms	Can explain the metabolism of microorganisms			
		11th	Breeding of microorganisms	Breeding of microorganisms can be explained.			
		12th	Breeding of microorganisms	Breeding of microorganisms can be explained.			
		13th	isolation and growth of microorganisms	Can explain about isolation and growth of microorganisms			
		14th	trophic form, material cycle and environmental conservation technology of microorganisms	To be able to explain about trophic form, material cycle and environmental conservation technology of microorganisms			
		15th	trophic form, material cycle and environmental conservation technology of microorganisms	To be able to explain about trophic form, material cycle and environmental conservation technology of microorganisms			
		16th					
Evaluation Method and Weight (%)							
	Quiz	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	40	30	0	0	30	0	100
Basic Proficiency	40	30	0	0	30	0	100

Specialized Proficiency	0	0	0	0	0	0	0
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Materials Engineering	
Course Information							
Course Code		1495202		Course Category		Specialized / Elective	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade		5th	
Term		Second Semester		Classes per Week		後期:2	
Textbook and/or Teaching Materials		Textbook : None、Reference book : 足立吟也・南努「現代無機材料科学」化学同人、(社)日本セラミックス協会「これだけは知っておきたいファインセラミックスのすべて」日刊工業新聞社					
Instructor		Konishi Tomoya					
Course Objectives							
1. To understand how to obtain materials from substances and explain the role of materials in society. 2. To explain the characteristics of various inorganic materials and the principles of their development. 3. To explain the functionality of various inorganic materials and the processing methods to realize it. 4. To discuss energy issues and explain the utilization of inorganic materials to solve them. 5. To propose the development and utilization of new materials.							
Rubric							
		Ideal Level		Standard Level		Unacceptable Level	
Achievement 1		Explains, with specific examples, the structure given to a material and the functionality.		Explains that materials are obtained by processing substances to give them form.		Cannot explain the difference between a substance and a material.	
Achievement 2		Explains how to improve the functionality of various inorganic materials.		Explains the structure and functionality of various inorganic materials.		Cannot give specific examples of the types of inorganic materials and their functionality.	
Achievement 3		Proposes how to solve social problems from the viewpoint of materials and how inorganic materials are potentially used to achieve these solutions.		Explains how to solve social problems from the viewpoint of materials and how inorganic materials are potentially used to achieve these solutions.		Cannot explain how to solve social problems from the viewpoint of materials and how to develop materials to realize them.	
Assigned Department Objectives							
学習・教育到達度目標 B-3 学習・教育到達度目標 D-1 学習・教育到達度目標 D-3							
Teaching Method							
Outline		Inorganic materials, such as ceramics, have a wide variety of advantages and functionalities and are widely used in our daily lives. In this lecture, we will focus on the morphology of inorganic materials, explore the origin of such advantages and functionality, and learn about cutting-edge applications. Since the functionality of materials is closely related to the processing methods that impart form, some of the topics covered in "Materials Processing" will also be included. The goal of this course is to provide students with the basic knowledge and skills to become practical engineers, while considering how to apply their previous knowledge in examining the functionality and utilization of inorganic materials.					
Style		The lecture will be given mainly using slides and writable worksheets, so there is no need to prepare notes or other materials. The lecture will be conducted by showing actual cases and concrete examples as much as possible. 【30 hrs of class time + 60 hrs of self-study】					
Notice		This course is a subject corresponding to the sub-major, and students will use the basic knowledge and concepts learned in chemistry, physics, and mathematics in general education to understand the functionality of various materials and the nature of phenomena. In addition, since manaba will be used for reviewing lectures and submitting assignments, students are required to have an Internet connection via PC or mobile terminal.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
2nd Semester	3rd Quarter	1st	Introduction to Materials Engineering		Explains the difference between a substance and a material, and the form and function of materials.		
		2nd	Basics of Ceramic Materials		Explains the characteristics of ceramic materials and fine ceramics.		
		3rd	Fundamentals of Crystals and Phase Transitions		Explains types of crystals, their physical properties, and phase transitions.		
		4th	Zirconia materials (I)		Explains about stabilization of zirconia and toughness of partially stabilized zirconia materials.		
		5th	Zirconia materials (II)		Explains functional properties of stabilized zirconia		
		6th	Processing Methods of Fine Ceramics		Explains about raw material purification process using complexes and various sintering methods.		
		7th	Soft Solution Chemistry Methods		Explains how to synthesize Fine Ceramics by solution processes.		
		8th	[Mid-term exam]				
	4th Quarter	9th	Dielectric materials		Explains structure and physical properties, types and applications of dielectric materials.		
		10th	Fluorescent materials		Explains the fluorescent emission characteristics of rare earth ions, and the characteristics and applications of inorganic fluorescent materials		

		11th	Magnetic Materials	Explains the characteristics and applications of magnetic materials.
		12th	Glass materials	Understands the characteristics of glass materials and explain processing, strengthening, and functionalization methods.
		13th	Nano Materials	Explains processing methods and functionalization of nano materials, using catalyst materials as an example.
		14th	Energy Materials (I)	Explains the structure and materials of fuel cells.
		15th	Energy Materials (II)	Explains structures and materials of dye-sensitized solar cells.
		16th	[Return of final exam]	

Evaluation Method and Weight (%)

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	0	0	0	0	30	100
Basic Proficiency	30	0	0	0	0	30	60
Specialized Proficiency	40	0	0	0	0	0	40
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Engineering for Semiconductors	
Course Information							
Course Code		1495802		Course Category		Specialized / Elective	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade		5th	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		Kisodensikougaku, Fuzimoto (Morikitasuyuppan)					
Instructor		Nakamura Atsunobu					
Course Objectives							
1. Understand electrical conduction phenomena in semiconductors and calculate carrier mobilities. 2. Understand the p-n junction and the current-voltage characteristics of semiconductors. 3. Understand characteristics and the working principle of transistors.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Achievement 1		Explain electric conduction phenomena based on the energy band structure of semiconductors and derive the equation of mobility.		Explain the behavior of electrons and holes based on the energy band structure of semiconductors and calculate values of carrier mobility.		Explain the difference between metals, semiconductors and insulators.	
Achievement 2		Derive equations of the rectification property and the junction capacitance of a p-n junction.		Understand the properties of p-n junctions and Current-voltage characteristics.		Draw a current-voltage curve for a p-n junction	
Achievement 3		Understand the working principle of transistors and explain the characteristics.		Explain the outline of the operation of a transistor and draw a diagram of current-voltage characteristics.		Draw a diagram of current-voltage characteristics.	
Assigned Department Objectives							
学習・教育到達度目標 D-1 学習・教育到達度目標 D-3							
Teaching Method							
Outline		Various semiconductor devices are used in most of the electronic products around us. In this lecture, you will learn the basic matters related to semiconductors that engineers need. Specifically, the structure of semiconductor devices and the working principle of them.					
Style		Lectures will be given according to the textbook, but the missing parts will be supplemented with exercises.					
Notice		This course requires basic knowledge of electromagnetism and differential equations. Please study these before starting this course.					
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input checked="" type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Energy band structure of solid 1		Understand the energy band structure.		
		2nd	Energy band structure of solid 2		Understand the role of electrons and holes.		
		3rd	Carrier density and electrical conductivity 1		Calculate the electron density of states from the solution of the Schrödinger equation.		
		4th	Carrier density and electrical conductivity 2		Calculate the carrier density using the Fermi-Dirac distribution function.		
		5th	Hall effect and mobility		Calculate carrier mobilities.		
		6th	Current and continuity equations 1		Calculate diffusion current and drift current.		
		7th	Current and continuity equations 2		Calculate carrier density taking recombination into account.		
		8th	Midterm exam				
	2nd Quarter	9th	P-N junction 1		Understand the current-voltage characteristics of a p-n junction.		
		10th	P-N junction 2		Calculate width of a depletion region.		
		11th	P-N junction 3		Calculate p-n junction capacitance.		
		12th	Bipolar transistor		Understand the structure and the working principle of bipolar transistors.		
		13th	Metal-semiconductor junction		Understand the difference between Schottky junction and Ohmic junction.		
		14th	MOSFET 1		Understand the structure and the working principle of MOSFET.		
		15th	MOSFET 2		Understand the structure and the working principle of MOSFET.		
		16th	Final exam				
Evaluation Method and Weight (%)							
	Examination	Quiz	Portfolio	Presentation/Attitude	Other	Total	

Subtotal	60	0	40	0	0	100
Basic Proficiency	20	0	10	0	0	30
Specialized Proficiency	40	0	30	0	0	70
Cross Area Proficiency	0	0	0	0	0	0

Anan College		Year	2024		Course Title	QuantumChemistry2
Course Information						
Course Code		1495806		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade	5th	
Term		First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials		教科書：真船文隆著「量子化学－基礎からのアプローチ」化学同人，近藤保・真船文隆著「新化学シリーズ 量子化学」裳華房				
Instructor		Yoshida Takehito				
Course Objectives						
1．等核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と波動関数を導出することができる。 2．異核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と波動関数を導出することができる。 3．多原子分子及び固体結晶に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と波動関数を導出することができる。						
Rubric						
		理想的な到達レベルの目安		標準的な到達レベルの目安		最低限の到達レベルの目安(可)
評価項目1		等核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と波動関数を導出することができる。また記号σ, π, g, uを用いてMOの分類ができる。簡単な等核2原子分子・イオンの結合次数を算出できる。		等核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位を導出することができる。また記号σ, π, g, uを用いてMOの分類ができる。		等核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位の導出の方法を説明できる。
評価項目2		異核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と波動関数を導出することができる。		異核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位を導出することができる。		異核2原子分子に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位の導出方法を説明できる。
評価項目3		多原子分子及び固体結晶に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位と状態関数を導出することができる。		多原子分子及び固体結晶に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位を導出することができる。		多原子分子及び固体結晶に原子軌道1次結合-分子軌道（LCAO-MO）法を適用することで、エネルギー準位の導出方法を説明できる。
Assigned Department Objectives						
学習・教育到達度目標 D-1						
Teaching Method						
Outline		本講義は、化学分野の基盤科目である物理化学の中でも、20世紀前半に急速に進展した量子化学について、その基礎を数学的手段を駆使した一貫した理論体系として把握する。次に化学への重要な応用として、分子と固体結晶の電子状態に関して数理的に理解することを学ぶ。具体的問題解法を多く取り入れることで理解力を涵養し、応用化学分野への適応能力を身につける。この科目は企業で、半導体集積素子の設計及び製造プロセスの研究・開発を担当していた教員が、その経験を活かし、多原子分子から固体について量子化学に基づいて講義形式で授業を行うものである。				
Style		授業内容は授業計画を参照すること。基本的に講義形式をとる。板書が主体であるが、関連資料のスライド紹介も取り入れる(特に分子軌道)。学生への発問はするので(3-5回/1コマ)、積極的に答えること。指名されない学生も積極的に考えること。計15回(計約60問)の課題は、自主的に考えて解き問題解法の力を養うこと。				
Notice		5年生前期までの数学・物理・物理化学系科目の知識を前提として活用するので、これらの内容をしっかり復習しておくこと。また授業各回毎に出された課題の実施を含む自学自習が不可欠である。授業時間内に自学自習課題の解説を十分に行うことは不可能なので、疑問点があれば質問に来自習。質問にあたっては、先ず自分で調べ考えてみて、何が理解できなかったのかをはっきりさせてから質問に来自習。シラバス指定参考書：「アトキンス 基礎物理化学 -分子論的アプローチ- (上)」東京化学同人				
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
1st Semester r	1st Quarter	1st	ボルン-オッペンハイマー（B-O）近似	B-O近似による水素分子イオンをモデル図示し、ハミルトニアンを書き下すことができる。		
		2nd	分子軌道（MO）法：	原子軌道1次結合（LCAO）によるMOの構成方法について説明できる。		
		3rd	分子軌道（MO）法：水素分子イオン	変分法をB-O近似水素分子イオンハミルトニアンに適用し、重なり積分，クーロン積分，共鳴積分，永年方程式について概略を説明できる。		
		4th	分子軌道（MO）法：水素分子イオン	LCAO-MO法を水素分子イオンに適用した際の、波動関数とエネルギー準位を導出することができる。		
		5th	分子軌道（MO）法：水素分子イオン	LCAO-MO法を水素分子イオンに適用した際の、クーロン積分について核間距離依存性などを定量的に図示・説明できる。		
		6th	分子軌道（MO）法：水素分子イオン	LCAO-MO法を水素分子イオンに適用した際の、共鳴積分について核間距離依存性などを定量的に図示・説明できる。		
		7th	分子軌道（MO）法：水素分子イオン	LCAO-MO法による水素分子イオンの、波動関数（結合性，反結合性）形状とエネルギー準位を核間距離の関数として図示することができる。重なり積分，クーロン積分，共鳴積分の挙動も併せて、水素分子イオンについての説明ができる。		
		8th	中間試験			

	2nd Quarter	9th	多原子分子：sp混成軌道	LCAO-MO法を用いて、BeH ₂ のsp混成軌道を導出することができる。
		10th	多原子分子：sp ² 混成軌道	LCAO-MO法を用いて、BH ₃ のsp ² 混成軌道を導出することができる。
		11th	多原子分子：sp ³ 混成軌道	LCAO-MO法を用いて、CH ₄ のsp ³ 混成軌道を導出することができる。
		12th	多原子分子：ヒュッケル近似	ヒュッケル近似について概要説明できる。エテン分子にヒュッケル近似を適用し、エネルギー準位を導出できる。
		13th	多原子分子：ヒュッケル近似	3ブタジエン分子パイ電子軌道にヒュッケル近似を適用し、エネルギー準位を導出し波動関数の概形を描ける。
		14th	固体の電子状態	LCAO-MO法を結晶モデルに適用し、エネルギーバンド構造の導出ができる。
		15th	固体の電子状態	フェルミ-ディラック分布を用いた絶縁体・半導体の電子構造について説明できる。バンドの底（有効質量近似）のエネルギー状態密度を計算することができる。
		16th	期末試験答案返却・解答解説	

Evaluation Method and Weight (%)

	定期試験	小テスト	ポートフォリオ	発表・取り組み姿勢	レポート・課題	Total
Subtotal	60	0	0	0	40	100
基礎的能力	20	0	0	0	10	30
専門的能力	30	0	0	0	20	50
分野横断的能力	10	0	0	0	10	20

Anan College		Year	2024		Course Title	QuantumChemistry3
Course Information						
Course Code		1495807		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Chemical Engineering		Student Grade	5th	
Term		Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials		教科書：近藤保・真船文隆著「新化学シリーズ 量子化学」 裳華房				
Instructor		Yoshida Takehito				
Course Objectives						
1. 量子化学の基本的近似法である摂動法, 変分法の概略を理解し、これら2種の近似法でHe原子の基底状態エネルギーを算出できる。 2. 電子スピン、多体系反対称性波動関数としてのスレーター行列式を理解し、2電子系問題に適用しエネルギー準位を導出する方法を説明できる。この過程でクーロン積分, 交換積分についても物理的意味を説明できる。 3. 軌道, スピン, 全角運動量演算子の各々の性質及び合成の規則を理解し、各原子軌道を項記号で表現できる。またフントの規則から各軌道の安定性を評価できる。さらに原子状態間遷移を項記号で表現でき、許容・禁制の選択側を判定できる。						
Rubric						
		理想的な到達レベルの目安		標準的な到達レベルの目安		最低限の到達レベルの目安(可)
評価項目1		量子化学の基本的近似法である摂動法, 変分法の概略を理解し、これら2種の近似法でHe原子の基底状態エネルギーを算出できる。		量子化学の基本的近似法である摂動法, 変分法の概略を理解し、どちらかの近似法でHe原子の基底状態エネルギーを算出できる。		量子化学の基本的近似法である摂動法, 変分法の概略を理解し、これら2種の近似法でHe原子の基底状態エネルギーを算出する方法を説明できる。
評価項目2		電子スピン、多体系反対称性波動関数としてのスレーター行列式を理解し、2電子系問題に適用しエネルギー準位を導出する方法を説明できる。この過程でクーロン積分, 交換積分についても物理的意味を説明できる。		電子スピン、多体系反対称性波動関数としてのスレーター行列式を理解し、2電子系問題に適用しエネルギー準位を導出する方針を説明できる。		電子スピン、多体系反対称性波動関数としてのスレーター行列式について説明できる。
評価項目3		軌道, スピン, 全角運動量演算子の各々の性質及び合成の規則を理解し、各原子軌道を項記号で表現できる。またフントの規則から各軌道の安定性を評価できる。さらに原子状態間遷移を項記号で表現でき、許容・禁制の選択側を判定できる。		軌道, スピン, 全角運動量演算子の各々の性質及び合成の規則を理解し、各原子軌道を項記号で表現できる。またフントの規則から各軌道の安定性を評価できる。		軌道, スピン, 全角運動量演算子の各々の性質及び合成の規則を理解し、各原子軌道を項記号で表現できる。
Assigned Department Objectives						
学習・教育到達度目標 D-1						
Teaching Method						
Outline		本講義は、化学分野の基盤科目である物理化学の中でも、20世紀前半に急速に進展した量子化学について、その基礎を数学的手段を駆使した一貫した理論体系として把握する。次に化学への重要な応用として、いくつかの近似法を用いて多電子原子の電子状態を数理的に理解することを学ぶ。具体的問題解法を多く取り入れることで理解力を涵養し、応用化学分野への適応能力を身につける。この科目は企業で、半導体集積素子の設計及び製造プロセスの研究・開発を担当していた教員が、その経験を活かし、多電子原子について量子化学に基づき講義形式で授業を行うものである。				
Style		授業内容は授業計画を参照すること。基本的に講義形式をとる。板書が主体であるが、関連資料のスライド紹介も取り入れる（特に分子軌道）。学生への発問はするので（3-5回/1コマ）、積極的に答えること。指名されない学生も積極的に考えること。計15回（計約60問）の課題は、自主的に考えて解き問題解法の力を養うこと。授業中に解法の説明を課すことがある。				
Notice		5年生前期までの数学・物理・物理化学系科目の知識を前提として活用するので、これらの内容をしっかり復習しておくこと。また授業各回毎に出された課題の実施を含む自学自習が不可欠である。授業時間内に自学自習課題の解説を十分に行うことは不可能なので、疑問点があれば質問に来ること。質問にあたっては、先ず自分で調べ考えてみて、何が理解できなかったのかをはっきりさせてから質問に来ること。 シラバス指定参考書：千原秀昭・江口太郎・斉藤一弥訳「マッカーリ・サイモン 物理化学（上）・（下）」東京化学同人				
Characteristics of Class / Division in Learning						
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input checked="" type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester	3rd Quarter	1st	量子化学における近似法の基礎	摂動法（1次）によりHe原子の基底状態エネルギー準位を導出することができる。		
		2nd	量子化学における近似法の基礎	変分法（試行関数をH原子1s状態とする）によりHe原子の基底状態エネルギー準位を導出することができる。		
		3rd	電子スピン	シュテルン-ゲラッハの実験、電子スピン角運動量の演算子・固有関数・固有値（固有方程式）について説明できる。		
		4th	波動関数の対称性・反対称性	波動関数の対称性と反対称性（電子は交換に対しては反対称）を数理的に表現できる。パウリの排他律と反対称性波動関数の関係を説明できる。		
		5th	スレーター行列式	多体系反対称性波動関数としてのスレーター行列式について説明できる。		

		6th	反対称性波動関数を用いたHe原子モデル	He原子中の2電子に 2×2 のスレーター行列式（反対称性波動関数）を適用し、エネルギー準位を導出する方法を説明できる。クーロン積分, 交換積分について数理的に説明できる。
		7th	前半のまとめと演習問題	
		8th	中間試験	
	4th Quarter	9th	ハミルトニアンと角運動量演算子	ハミルトニアンと軌道角運動量 L^2 , L_z 及びスピン角運動量 s^2 , s_z の交換関係を算出できる。これらの同時観測性を説明できる。
		10th	スピン軌道相互作用	スピン軌道相互作用のハミルトニアン H_{so} を数理的に表現でき、軌道角運動量 L_z , スピン角運動量 S_z , 全角運動量 J_z , J^2 ($J=L+S$) との交換関係を算出できる、これらの同時観測性を説明できる。
		11th	原子の項記号	原子の項記号 (L, S) を理解し、原子軌道を項記号によって表現できる。
		12th	ラッセル-ソーネダース (LS) 結合	LS結合法による全角運動量の合成を理解し、原子軌道を項記号で表現できる。
		13th	フントの規則	フントの規則にしたがって項記号で表現された原子軌道の安定性を評価できる。
		14th	原子スペクトルと項記号	L, S, J の変化で表現された原子状態間遷移の選択則を項記号表現に適用し、遷移の許容・禁制の判定ができる。
		15th	後半のまとめと演習問題	
		16th	期末試験答案返却及び解説	

Evaluation Method and Weight (%)

	定期試験	小テスト	ポートフォリオ	発表・取り組み姿勢	課題・レポート	Total
Subtotal	60	0	0	0	40	100
基礎的能力	20	0	0	0	10	30
専門的能力	30	0	0	0	20	50
分野横断的能力	10	0	0	0	10	20

Anan College		Year	2024		Course Title	Polymer Chemistry	
Course Information							
Course Code	1495A01		Course Category		Specialized / Elective		
Class Format	Lecture		Credits		Academic Credit: 2		
Department	Course of Chemical Engineering		Student Grade		5th		
Term	Second Semester		Classes per Week		後期:2		
Textbook and/or Teaching Materials							
Instructor	Otani Takashi						
Course Objectives							
Rubric							
	Ideal Level		Standard Level		Unacceptable Level		
Achievement 1	Can explain in detail the structure and synthesis of polymers		Can explain the structure and synthesis of polymers		Cannot explain the structure and synthesis of polymers		
Achievement 2	Describe in detail the types of polymers, their thermal and mechanical properties and functionality		Describe the types of polymers, their thermal and mechanical properties and functionality		Unable to describe in detail the types of polymers, their thermal and mechanical properties and functionality		
Achievement 3							
Assigned Department Objectives							
学習・教育到達度目標 D-1							
Teaching Method							
Outline	Polymers can be broadly classified into natural polymers, such as fibers and foods found in nature, and synthetic polymers, such as plastics and films synthesized by humans. In this course, students will learn how the polymers that exist around us are synthesized, as well as their types and properties.						
Style	In addition to lectures based on textbooks and handouts, exercises and experiments will be conducted as needed to deepen understanding.						
Notice							
Characteristics of Class / Division in Learning							
<input type="checkbox"/> Active Learning		<input type="checkbox"/> Aided by ICT		<input type="checkbox"/> Applicable to Remote Class		<input type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme	Goals			
2nd Semester	3rd Quarter	1st	Introduction Macromolecules around us	Explain what polymers are, the birth and history of polymer chemistry, the polymer industry, and the classification of polymers.			
		2nd	Introduction to Natural Polymers	Can explain natural polymers.			
		3rd	Introduction to Synthetic Polymers	Can explain synthetic polymers.			
		4th	Physical Properties of Polymers 1	Explain thermal and mechanical properties of polymers.			
		5th	Physical Properties of Polymers 2	Explain electrical and optical properties of polymers.			
		6th	Sequential polymerization 1	Explain the synthesis of polymers by polycondensation reactions.			
		7th	Sequential polymerization 2	Explain the synthesis of polymers by polyaddition reactions.			
		8th	Sequential polymerization 3	Explain the synthesis of Polymers by Addition-Condensation Polymerization Reaction.			
	4th Quarter	9th	Midterm examination	Can fully explain what was taught in the first half of the course.			
		10th	Radical polymerization of vinyl monomers	Explain the synthesis of polymers by polymerization and radical polymerization of vinyl monomers.			
		11th	Radical copolymerization	Explain the synthesis of polymers by radical copolymerization.			
		12th	Cationic and anionic polymerization	Explain the synthesis of polymers by cationic and anionic polymerization.			
		13th	Ring-opening polymerization	Explain the synthesis of polymers by ring-opening polymerization.			
		14th	Functional polymer 1	Can explain functional polymers.			
		15th	Functional polymer 2	Can synthesize functional polymers.			
		16th					
Evaluation Method and Weight (%)							
	Examination	Assignment Submission	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	70	30	0	0	0	0	100

Basic Proficiency	25	20	0	0	0	0	45
Specialized Proficiency	35	10	0	0	0	0	45
Cross Area Proficiency	10	0	0	0	0	0	10