

Anan College				Course of Applied Chemical Engineering				Year		2024					
Department Goals															
Course Category		Course Title	Course Code	Credit Type	Credits	Class Hours per Week								Instructor	Division in Learning
						Adv. 1st Y				Adv. 2nd Y					
						1st		2nd		1st		2nd			
						1Q	2Q	3Q	4Q	1Q	2Q	3Q	4Q		
AZ	Compulsory	Instrumental Analysis	5516Z01	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Yamada Yohei	
AZ	Elective	Electronic Device Engineering	5596E01	Academic Credit	2	<div><div></div><div></div><div>2</div><div></div><div></div><div></div><div></div></div>								Hasegawa Tatsuo	
AZ	Elective	Electrical Circuits and Analysis	5596E03	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Nakamura Yuichi	
AZ	Elective	Material Processing	5596M03	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Yasuda Takeshi	
AZ	Elective	Simulation Engineering	5596M04	Academic Credit	2	<div><div></div><div></div><div>2</div><div></div><div></div><div></div><div></div></div>								Matsura Fuminori	
Specialized	Compulsory	Synthetic Organic Chemistry	5516Z02	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Sugiyama Yuuki	
Specialized	Compulsory	Advanced Physical Chemistry	5516Z03	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Konishi Tomoya	
Specialized	Elective	Environmental Chemistry	5596101		2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Ota Naotomo	
Specialized	Elective	Solid State Chemistry	5596Z04	Academic Credit	2	<div><div>2</div><div></div><div></div><div></div><div></div><div></div><div></div></div>								Konishi Tomoya	
Specialized	Compulsory	Experiments in Applied Chemistry	5517J01	Academic Credit	2	<div><div></div><div></div><div></div><div></div><div>6</div><div></div><div></div></div>								Otani Takashi, Sugiyama Yuuki, Ueda Kohei, Ezure Ryosuke	
Specialized	Compulsory	Synthetic Organic Chemistry	5517Z02		2	<div><div></div><div></div><div></div><div></div><div>4</div><div></div><div></div></div>								Sugiyama Yuuki	
Specialized	Compulsory	Advanced Physical Chemistry	5517Z03	Academic Credit	2	<div><div></div><div></div><div></div><div></div><div>2</div><div></div><div></div></div>								Konishi Tomoya	
Specialized	Elective	Environmental Chemistry	5597101	Academic Credit	2	<div><div></div><div></div><div></div><div></div><div>2</div><div></div><div></div></div>								Ota Naotomo	
Specialized	Elective	Composite Materials	5597C04	Academic Credit	2	<div><div></div><div></div><div></div><div></div><div>2</div><div></div><div></div></div>								Kadono Takuma	
Specialized	Elective	Mathematics of Electronics and Information	5597E02	Academic Credit	2	<div><div></div><div></div><div></div><div></div><div>2</div><div></div><div></div></div>								Sugino Ryuza-buro	

Sp eci ali ze d	El ec tiv e	Semiconductor Material Properties	5597E 04	Acade mic Credit	2	<div> <div></div> <div></div> <div></div> <div></div> <div></div> <div></div> <div>2</div> </div>	Haseg awa Tatsuo	
Sp eci ali ze d	El ec tiv e	Signal Processing Engineering	5597I 03	Acade mic Credit	2	<div> <div></div> <div></div> <div></div> <div></div> <div>2</div> <div></div> <div></div> </div>	Yasun o Emiko	
Sp eci ali ze d	El ec tiv e	Strength and Fracture of Materials	5597M 02	Acade mic Credit	2	<div> <div></div> <div></div> <div></div> <div></div> <div>2</div> <div></div> <div></div> </div>	Okum oto Yoshih iro	
Sp eci ali ze d	El ec tiv e	Solid State Chemistry	5597Z 04		2	<div> <div></div> <div></div> <div></div> <div></div> <div>4</div> <div></div> <div></div> </div>	Konish i Tomoy a	

Anan College		Year	2024	Course Title	Instrumental Analysis
Course Information					
Course Code	5516Z01		Course Category	AZ / Compulsory	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Applied Chemical Engineering		Student Grade	Adv. 1st	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	エキスパート応用化学テキストシリーズ 機器分析 大谷肇 編 講談社 (ISBN978-4-06-156807-5)				
Instructor	Yamada Yohei				
Course Objectives					
After taking this course, you will be able to 1. explain the interaction between electromagnetic waves and materials. 2. explain the measurement principles of the analytical instruments covered in the lecture. 3. discuss and devise analytical methods according to the sample to be measured and the information to be obtained. 4. explain to others the principles of the instruments used in one's own research and the information obtained.					
Rubric					
	Ideal Level		Standard Level		Unacceptable Level
1. Explain the interaction between electromagnetic waves and matter	You are able to use the equations relating wavelength, frequency, and energy of electromagnetic waves, accurately. You are able to explain at least three specific examples of interactions between electromagnetic waves and matter (electronic transitions, vibrational transitions, etc.).		You are able to use the equations relating wavelength, frequency, and energy of electromagnetic waves. You are able to explain at least two specific examples of interactions between electromagnetic waves and matter (electronic transitions, vibrational transitions, etc.).		If you read textbooks, you are able to use the equations relating wavelength, frequency, and energy of electromagnetic waves. You are able to explain at least two specific examples of interactions between electromagnetic waves and matter (electronic transitions, vibrational transitions, etc.).
2. To be able to explain the measurement principles of the analytical instruments covered in the lecture.	You are able to explain at least six measurement principles of various analytical instruments covered in the textbook. You are able to explain the characteristics of each instrument and how to use them.		You are able to explain at least four measurement principles of various analytical instruments covered in the textbook. You are able to explain the characteristics of each instrument and how to use them.		If you read textbooks, you are able to explain at least four measurement principles of various analytical instruments covered in the textbook. You are able to explain the characteristics of each instrument and how to use them.
3. Discuss and devise analytical methods according to the sample to be measured and the information to be obtained.	You are able to suggest analytical methods according to the sample and the information to be obtained. You are able to image sample preparation.		You are able to suggest analytical methods according to the sample and the information to be obtained.		If you read textbooks, You are able to suggest analytical methods according to the sample and the information to be obtained.
4. Be able to explain to others the principles of the equipment used in his/her research and the information obtained.	You are able to do presentation of your research and explain analytical instruments using in your research. Also, you are able to ask question for research of others, at good pace.		You are able to do presentation of your research and explain analytical instruments using in your research. Also, you are able to ask question for research of others.		You are able to do presentation of your research and explain analytical instruments using in your research.
Assigned Department Objectives					
Teaching Method					
Outline	Analytical chemistry is the study of the composition and content of samples and the analysis of their chemical state and existence. Instrumental analysis plays a central role in analytical chemistry and is indispensable in all human activities, including substance development, quality control, environmental investigation, and medical care. In general, analytical instruments are classified based on their principles into electromagnetic analysis, electrical analysis, separation analysis, and others (thermal analysis, mass spectrometry). First, students will learn about the principles and equipment configuration of these analytical instruments. Students will also learn what kind of information can be obtained from the results obtained from these analytical instruments.				
Style	Basically classroom learning, but there are also laboratory 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 r	1st Quarter	1st	Introduction to Instrumental Analysis, Interaction of Electromagnetic Waves and Materials	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.	
		2nd	Interaction of electromagnetic waves with matter, UV-Vis	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.	
		3rd	fluorospectrophotometer	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.	

		4th	AAS	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.
		5th	ICP-AES, ICP-MS	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.
		6th	experimental design for analysis of mineral water by using ICP-AES	experimental design for analysis of mineral water by using ICP-AES.
		7th	Experiment	preparation of standard solution for analysis of mineral water.
		8th	Experiment	ICP-AES measurement
	2nd Quarter	9th	Data handling of the experiment by Excel	Data handling of the experiment by Excel
		10th	FT-IR	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.
		11th	FT-IR, Raman spectrometry	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.
		12th	XRD, XRF	You are able to explain the principles of the equipment, how to prepare samples, and how to view the data obtained.
		13th	Presentation of the students	Students will present their own research and the analytical instruments they use.
		14th	Presentation of the students	Students will present their own research and the analytical instruments they use.
		15th	Presentation of the students	Students will present their own research and the analytical instruments they use.
		16th	final exam	final exam

#### Evaluation Method and Weight (%)

	Examination	Presentation	reports	Total
Subtotal	50	20	30	100
Basic Proficiency	50	20	30	100
Specialized Proficiency	0	0	0	0
Cross Area Proficiency	0	0	0	0

Anan College		Year	2024		Course Title	Electronic Device Engineering
Course Information						
Course Code	5596E01			Course Category	AZ / Elective	
Class Format				Credits	Academic Credit: 2	
Department	Course of Applied Chemical Engineering			Student Grade	Adv. 1st	
Term	Second Semester			Classes per Week	後期:2	
Textbook and/or Teaching Materials	基礎から学ぶ半導体電子デバイス（森北出版）					
Instructor	Hasegawa Tatsuo					
Course Objectives						
1. 半導体のエネルギーバンド図を説明でき、キャリア密度に関する諸式を導出できる。 2. pn接合ダイオードの特性をエネルギーバンド図を用いて説明でき、動作に関わる諸量を求めることができる。 3. 金属と半導体の接合の特性をエネルギーバンド図を用いて説明でき、動作に関わる諸量を求めることができる。 4. トランジスタ、サイリスタの動作原理をエネルギーバンド図を用いて説明できる。 5. JFET、MOSFETの動作原理をエネルギーバンド図を用いて説明できる。						
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		最低限の到達レベルの目安(不可)	
到達目標1	半導体のエネルギーバンド図を説明でき、キャリア密度に関する諸式を導出できる。		半導体のエネルギーバンド図を説明でき、キャリア密度について説明できる。		半導体のエネルギーバンド図を説明できる。	
到達目標2	pn接合ダイオードの特性をエネルギーバンド図を用いて説明でき、動作に関わる諸量を求めることができる。		pn接合ダイオードの特性をエネルギーバンド図を用いて説明できる。		pn接合ダイオードの特性を説明できる。	
到達目標3	金属と半導体の接合の特性をエネルギーバンド図を用いて説明でき、動作に関わる諸量を求めることができる。		金属と半導体の接合の特性をエネルギーバンド図を用いて説明できる。		金属と半導体の接合の特性を説明できる。	
到達目標4	トランジスタ、サイリスタの動作原理をエネルギーバンド図を用いて説明できる。		トランジスタ、サイリスタの動作原理を説明できる。		トランジスタ、サイリスタの基本特性を説明できる。	
到達目標5	JFET、MOSFETの動作原理をエネルギーバンド図を用いて説明できる。		JFET、MOSFETの動作原理を説明できる。		JFET、MOSFETの基本特性を説明できる。	
Assigned Department Objectives						
Teaching Method						
Outline	半導体の基本的性質およびキャリア輸送についてエネルギーバンドモデルを用いて学習し、pn接合ダイオード、ショットキー接合ダイオード、バイポーラトランジスタ、サイリスタ、電界効果トランジスタなど、さまざまな電子デバイスの構造・特性・動作原理について理解することを目的とする。					
Style	講義形式を中心に授業を進める。 【授業時間30時間+自学自習時間60時間】					
Notice						
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 type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme	Goals		
2nd Semester	3rd Quarter	1st	半導体の基礎	半導体の定義を説明できる。 孤立原子、結晶のエネルギー構造を説明できる。		
		2nd	半導体の基礎	真性半導体、p型・n型の不純物半導体について説明できる。		
		3rd	半導体中のキャリア密度	真性半導体のキャリア密度に関する諸式を導出できる。 真性、不純物半導体のキャリア密度の図を説明できる。		
		4th	半導体中のキャリア密度 半導体中のキャリア輸送現象	絶縁体、半導体、導体のエネルギーバンドを説明できる。 ドリフト電流と拡散電流を説明できる。		
		5th	pn接合ダイオード	pn接合ダイオードの特性をエネルギーバンド図を用いて説明できる。		
		6th	pn接合ダイオード	pn接合ダイオードの特性に関する諸式をポアソン方程式より導出できる。		
		7th	pn接合ダイオード	pn接合ダイオードの電圧-電流特性の式を導出できる。		
		8th	【中間試験】			
	4th Quarter	9th	金属と半導体の接合による整流特性	金属と半導体の接合の特性をエネルギーバンド図を用いて説明できる。		
		10th	金属と半導体の接合による整流特性	金属と半導体の接合の特性をエネルギーバンド図を用いて説明できる。		
		11th	金属と半導体の接合による整流特性	pn接合ダイオードの特性に関する諸式をポアソン方程式より導出できる。		

		12th	バイポーラトランジスタ	バイポーラトランジスタの特性をエネルギーバンド図を用いて説明できる。
		13th	バイポーラトランジスタ	サイリスタの特性をエネルギーバンド図を用いて説明できる。
		14th	接合型電界効果トランジスタ（JFET）	接合型FETの特性を構造図を用いて説明できる。
		15th	MOS型電界効果トランジスタ（MOSFET）	MOS形FETの特性を構造図とエネルギーバンド図を用いて説明できる。
		16th	【学年末試験、答案返却】	

#### 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	その他	Total
Subtotal	80	0	20	0	0	100
基礎的能力	40	0	10	0	0	50
専門的能力	40	0	10	0	0	50
分野横断的能力	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Electrical Circuits and Analysis
Course Information						
Course Code	5596E03			Course Category	AZ / Elective	
Class Format	Lecture			Credits	Academic Credit: 2	
Department	Course of Applied Chemical Engineering			Student Grade	Adv. 1st	
Term	First Semester			Classes per Week	前期:2	
Textbook and/or Teaching Materials						
Instructor	Nakamura Yuichi					
Course Objectives						
1. Able to explain the characteristics and functions of basic elements. 2. Able to derive circuit equations for basic circuits and explain dynamic characteristics. 3. Can explain how to derive and solve circuit equations for circuits containing L and C. 4. Understand the concept of system equations and be able to express system equations corresponding to circuits. 5. Able to solve system equations and explain the dynamic characteristics of circuits.						
Rubric						
	Ideal Level		Standard Level		Minimum Attainment Level	
Achievement 1	Able to explain in detail the characteristics and effects of basic elements using mathematical formulas, etc.		Able to explain the characteristics and effects of basic elements using formulas.		Able to explain the characteristics and actions of basic elements.	
Achievement 2	Able to systematically derive circuit equations for basic circuits. Also, be able to solve it and explain its dynamic characteristics.		Able to derive circuit equations for basic circuits. Also, be able to explain the steps to solve an equation.		Able to derive circuit equations for simple circuits.	
Achievement 3	Able to derive circuit equations expressed as higher-order differentials. Also, be able to concretely solve the problem.		Able to derive circuit equations expressed up to second-order differentials. Also, be able to explain the solution.		Able to derive circuit equations expressed as first-order differentials. Also, be able to explain the solution.	
Achievement 4	Understand the concept of system equations and be able to express system equations corresponding to various circuits.		Understand the concept of system equations and be able to express system equations that correspond to basic circuits.		Understand the concept of system equations and be able to express system equations that correspond to simple circuits.	
Achievement 5	Able to solve various system equations and explain the dynamic characteristics of circuits in detail.		Able to solve basic system equations and outline the dynamic characteristics of a circuit.		Able to solve simple system equations and provide an overview of the dynamic characteristics of a circuit.	
Assigned Department Objectives						
Teaching Method						
Outline	Transient phenomena for circuits with various configurations are analyzed using system state equations. The goal is to learn about multiple types of analysis methods and understand the characteristics and methods of each, so that you can select the most suitable method for your purpose.					
Style	Learn about the concepts and methods for analyzing the dynamic characteristics of electrical circuits. Exercises and report assignments will also be conducted to help students understand the content of the class.					
Notice	The content of this lecture is a method that can be commonly applied to the analysis of linear dynamical systems. By becoming familiar with the notation and analysis procedures used here, students will develop skills that can be applied to more practical system analysis.					
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 type="checkbox"/> Instructor Professionally Experienced
Course Plan						
			Theme		Goals	
1st Semester	1st Quarter	1st	1. Dynamic characteristics of basic circuits (1) Dynamic element		Able to derive circuit equations for basic circuits and explain dynamic characteristics. - Able to explain the individual characteristics and actions of dynamic elements.	
		2nd	1. Dynamic characteristics of basic circuits (2) Circuit equation		Able to derive circuit equations for basic circuits and explain dynamic characteristics. - Circuit equations can be found for basic circuits.	
		3rd	1. Dynamic characteristics of basic circuits (3) Dynamic characteristics		Able to derive circuit equations for basic circuits and explain dynamic characteristics. - Able to solve circuit equations of basic circuits and explain dynamic characteristics.	
		4th	1. Dynamic characteristics of basic circuits (3) Dynamic characteristics		Able to derive circuit equations for basic circuits and explain dynamic characteristics. - Able to solve circuit equations of basic circuits and explain dynamic characteristics.	
		5th	2. Dynamic analysis method (1) Ordinary differential equations and their solutions		Able to explain how to derive and solve circuit equations for circuits containing L and C. - Understand constant coefficient ordinary differential equations and be able to explain the steps to solve them.	

		6th	2. Dynamic analysis method (1) Ordinary differential equations and their solutions	Able to explain how to derive and solve circuit equations for circuits containing L and C. - Understand constant coefficient ordinary differential equations and be able to explain the steps to solve them.
		7th	2. Dynamic analysis method (1) Ordinary differential equations and their solutions	Able to explain how to derive and solve circuit equations for circuits containing L and C. - Understand constant coefficient ordinary differential equations and be able to explain the steps to solve them.
		8th	[Midterm Exam]	Check your understanding of the lesson content up to the midterm exam.
	2nd Quarter	9th	3. System equations and their solutions (1) Representation of system equations	Understand the concept of system equations and be able to specifically derive and solve them. - Understand the concept of system equations and be able to derive them for a given circuit.
		10th	3. System equations and their solutions (1) Representation of system equations	Understand the concept of system equations and be able to specifically derive and solve them. - Understand the concept of system equations and be able to derive them for a given circuit.
		11th	3. System equations and their solutions (2) Exponential function of matrix and its properties	Understand the concept of system equations and be able to specifically derive and solve them. - Able to explain the exponential function of the matrix used to solve system equations and its properties.
		12th	3. System equations and their solutions (2) Exponential function of matrix and its properties	Understand the concept of system equations and be able to specifically derive and solve them. - Able to explain the exponential function of the matrix used to solve system equations and its properties.
		13th	3. System equations and their solutions (3) Solution of system equations	Understand the concept of system equations and be able to specifically derive and solve them. - Able to specifically derive the derived system equation.
		14th	3. System equations and their solutions (3) Solution of system equations	Understand the concept of system equations and be able to specifically derive and solve them. - Able to specifically derive the derived system equation.
		15th	3. System equations and their solutions (3) Solution of system equations	Understand the concept of system equations and be able to specifically derive and solve them. - Able to specifically derive the derived system equation.
		16th	[Final exam] [Answer return time]	Check your understanding of the lesson content.

#### Evaluation Method and Weight (%)

	Examination	Report/Assignment	Total
Subtotal	80	20	100
Basic Proficiency	30	5	35
Specialized Proficiency	40	10	50
Cross Area Proficiency	10	5	15



Anan College		Year	2024		Course Title	Material Processing
Course Information						
Course Code		5596M03		Course Category	AZ / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade	Adv. 1st	
Term		First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials		Materials will be distributed as needed.				
Instructor		Yasuda Takeshi				
Course Objectives						
1. Student be able to understand and explain various processing methods for metallic materials and their characteristics and relevance. 2. Student be able to understand and explain various molding methods for ceramics, resins, and composite materials, and their characteristics. 3. Student be able to understand and explain heat treatment and surface treatment, their necessity and effects. 4. Student be able to understand and explain various joining methods and their characteristics.						
Rubric						
		Ideal Level		Standard Level		Minimum Level
Achievement 1		Student be able to understand and explain various processing methods of metallic materials and their characteristics and relevance.		Student be able to understand and explain various processing methods for metallic materials.		Student understand various processing methods for metal materials.
Achievement 2		Student be able to understand and explain various molding methods for ceramics and resins/composites and their characteristics.		Student be able to understand and explain various forming methods for ceramics and resins/composites.		Student understand various molding methods for ceramics, resins and composites.
Achievement 3		Student be able to understand and explain the necessity and effects of heat treatment and surface treatment.		Student be able to understand and explain heat treatment and surface treatment.		Student understand heat treatment and surface treatment heat treatments.
Achievement 4		Student be able to understand and explain various joining methods and their characteristics.		Student be able to understand and explain various joining methods.		Student understand various joining methods.
Assigned Department Objectives						
Teaching Method						
Outline		Metallic materials (especially steel), ceramics, and resins, which are widely utilized in industrial products, are processed into various shapes according to their applications. As engineers and designers involved in manufacturing, it is necessary to understand the phenomena and characteristics of various materials during processing in order to select appropriate material processing methods. In this course, students will acquire basic knowledge of various processing and forming methods for metallic materials, ceramics, and resins, as well as heat treatment and surface treatment of some materials.				
Style		Classes will be conducted in a lecture style. Reports will be required as pre- and post-assessments. [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	
1st Semester	1st Quarter	1st	Overall view of material processing methods		Student be able to explain an overview of this course and an view overall how materials are processed.	
		2nd	Processing methods for metallic materials		Student be able to explain various processing methods for metallic materials.	
		3rd	Processing methods for metallic materials		Student be able to explain various processing methods for metallic materials.	
		4th	Ceramics forming methods		Student be able to explain ceramics forming methods.	
		5th	Molding methods for resins and composites		Student be able to explain molding methods for resins and composites.	
		6th	Basics of heat treatment		Student be able to explain the basics of heat treatment of steel materials.	
		7th	Basics of heat treatment		Student be able to explain the basics of heat treatment of steel materials.	
		8th	Heat treatment in actual		Student be able to explain heat treatment in actual.	
	2nd Quarter	9th	Midterm examination			
		10th	Surface Treatment		Student be able to explain various surface treatment methods.	

		11th	Surface Treatment	Student be able to explain various surface treatment methods.
		12th	Mechanical bonding	Student be able to explain various mechanical bonding.
		13th	Adhesion	Student be able to explain about adhesion.
		14th	Liquid phase bonding and solid phase bonding	Student be able to explain various methods of liquid-phase bonding and solid-phase bonding.
		15th	Liquid phase bonding and solid phase bonding	Student be able to explain various methods of liquid-phase bonding and solid-phase bonding.
		16th	Final examination and return exam. paper	

Evaluation Method and Weight (%)							
	Midterm/Final exam	Quiz	Portfolio	Presentation/Attitude	Portfolio	Other	Total
Subtotal	80	0	20	0	0	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	60	0	20	0	0	0	80
Cross Area Proficiency	20	0	0	0	0	0	20

Anan College		Year	2024		Course Title	Simulation Engineering	
Course Information							
Course Code		5596M04		Course Category		AZ / Elective	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade		Adv. 1st	
Term		Second Semester		Classes per Week		後期:2	
Textbook and/or Teaching Materials		Pythonによる数値計算とシミュレーション（オーム社）					
Instructor		Matsuura Fuminori					
Course Objectives							
1. Can perform modeling with 3D CAD and carry out linear stress analysis, fluid analysis, and heat transfer analysis. 2. Can create a program that simulates the motion of a particle based on ordinary differential equations.							
Rubric							
		Ideal Level		Standard Level		Unacceptable Level	
SolidWorks Simulation		Can perform element division considering analysis accuracy and conduct linear stress, fluid, and heat transfer analyses.		Can model complex parts with 3D-CAD and perform linear stress, fluid, and heat transfer analyses.		Can model simple parts with 3D-CAD and perform linear stress, fluid, and heat transfer analyses.	
Creating Own Numerical Simulation Code		Can add additional features to the code listed in the textbook.		Can create simulation code with functions equivalent to the code listed in the textbook.		Cannot implement functions equivalent to the code listed in the textbook.	
Assigned Department Objectives							
Teaching Method							
Outline		Numerical analysis methods such as the finite element method have become powerful tools for all engineering fields. In this lecture, we utilize analysis software linked with 3D CAD to perform stress analysis, heat transfer analysis, and fluid analysis. In the latter part, students will acquire the basics of computational mechanics and learn about physical simulations based on ordinary differential equations, simulations using cellular automata, and stochastic simulations using random numbers.					
Style		The first half of the course focuses on learning what can be simulated with analysis using 3D CAD software. In the second half, students create programs for numerical calculation. Although program examples are provided in Python 3, students are allowed to implement in any programming language they are proficient in. As this course offers academic credits, submission of reports as pre- and post-study activities is mandatory. [Lecture hours: 31 hours + Self-study hours: 60 hours]					
Notice		Proficiency in operating 3D CAD software and programming languages is desirable.					
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	Model Creation and Mass Properties		Can model a member, apply materials, and investigate mass properties.		
		2nd	Stress Analysis		Able to perform linear stress analysis.		
		3rd	Heat Transfer Analysis		Can calculate the steady-state temperature distribution of a member.		
		4th	Heat Transfer Analysis		Can calculate the transient temperature distribution of a member.		
		5th	Fluid Analysis		Can calculate the velocity and pressure distribution of an external flow fluid.		
		6th	Fluid Analysis		Can calculate the velocity and pressure distribution of an internal flow fluid.		
		7th	Midterm Exam		Practical exam using SolidWorks.		
		8th	Fundamentals of Numerical Calculation		Can perform square root calculations through numerical calculation and explain numerical calculation and errors.		
	4th Quarter	9th	Physical Simulation Based on Ordinary Differential Equations		Can create simulation code for free fall and landing spacecraft using Euler's method.		
		10th	Physical Simulation Based on Ordinary Differential Equations		Can create simulation code for 2D motion based on potential.		
		11th	Simulation Using Cellular Automata		Can create simulation code using 1D cellular automata.		
		12th	Simulation Using Cellular Automata		Can create simulation code for traffic flow and the Game of Life.		
		13th	Stochastic Simulation Using Random Numbers		Can explain pseudo-random numbers and numerical integration. Can create simulation code for the knapsack problem.		
		14th	Stochastic Simulation Using Random Numbers		Can create simulation code for a random walk.		
		15th	Final Exam				
		16th					
Evaluation Method and Weight (%)							

	Examination	Presentation	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	10	0	0	0	90	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	10	0	0	0	90	0	100
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Advanced Physical Chemistry	
Course Information							
Course Code		5516Z03		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade		Adv. 1st	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		平山令明「はじめての量子化学」講談社ブルーバックス / 染川賢一「有機分子の分子軌道計算と活用」九州大学出版会					
Instructor		Konishi Tomoya					
Course Objectives							
1. Explains the concept and principle of molecular orbital method. 2. Uses molecular orbital calculation software. 3. Discusses various properties and reactions of molecules using molecular orbital calculation.							
Rubric							
		Ideal Level		Standard Level		Acceptable Level	
Achievement 1		Explains the calculation method of molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Explains molecular orbitals.	
Achievement 2		Calculates charge distribution and electron density by molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Calculates molecular conformation by molecular orbital method.	
Achievement 3		Discusses the reactivity of molecules by molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Discusses the stability of molecules by molecular orbital method.	
Assigned Department Objectives							
Teaching Method							
Outline		We have so far learned about the various physical properties exhibited by materials and that "physical properties" are determined by the "composition" and "structure" of a material. Why is that? The key is the Schrödinger's equation $H\psi=E\psi$ . In this lecture, through the molecular orbital method, we will understand that the electronic state of a molecule is determined by its "composition" and "structure," and that physical properties can be explained in principle by them. After reviewing the concept of molecular orbital, specific quantum chemical calculation methods (Hartree-Fock method, variational method, and self-consistency method) will be introduced. Next, students will perform actual molecular orbital calculations on several molecules and discuss their conformation, polarity, acidity, color, reactivity, and so on. As a practical application, students will measure the infrared absorption spectra of organic polymers and compare them with the results calculated by the molecular orbital method.					
Style		Students will learn through lectures and practical training. The laboratory will be conducted in a BYOD style, so bring your own laptop computer and earphones. Hands-on learning will be conducted using molecular structure modeling software and quantum chemical calculation software installed on each student's laptop. The periodic examination will include a practical test on the quantum chemical calculation software.					
Notice		Students are required to read the sections of the textbook related to the contents of each week's class in advance. Syllabus-designated reference book: 藤永茂「入門分子軌道法」講談社					
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 r	1st Quarter	1st	Lecture: The Origin of Atoms		1. Explains atomic structure and electron configuration. 2. Explains wavefunction and Schrödinger equation. 3. Explains quantum numbers and their constitutive principles.		
		2nd	Lecture: From Atoms to Molecules (1)		1. Explains molecular orbitals. 2. Explains how to derive molecular orbitals. 3. Derives molecular orbitals of hydrogen molecules.		
		3rd	Exercise: From Atoms to Molecules (2)		1. Uses quantum chemical calculation software. 2. Calculates molecular orbitals of hydrogen molecules. 3. Displays molecular orbitals of hydrogen molecules.		
		4th	Lecture: What is obtained from molecular orbital method (1)		1. Explains many-body problems. 2. Explains Hartree equation. 3. Explains variational and self-consistency methods.		
		5th	Exercise: What we can obtain from molecular orbital method (2)		1. Calculate the conformation of ethane. 2. Calculates molecular orbitals of ethane. 3. Calculates electron density and heat of formation of ethane.		
		6th	Lecture: What is required from Molecular Orbital Method (3)		1. Explains Slater determinant and Hartree-Fock equation. 2. Explains the LCAO approximation and the Hartree-Fock-Roothaan equation. 3. Explains the difference between non-empirical and semi-empirical molecular orbital methods.		
		7th	Exercise: Knowing the structure of molecules (1)		1. Explains the Z-matrix. 2. Performs structural optimization calculations and explains the delocalization of pi electrons by structural optimization calculation. 3. Performs conformational analysis of molecules.		

		8th	Lecture/Exercise: Knowing the Structure of Molecules (2)	1. Calculates heat of formation of a molecule and discusses its stability 2. Calculates orbital energy of molecules and discusses reactivity. 3. Calculate electrostatic potential of molecules and discusses polarity.
	2nd Quarter	9th	Lecture/Exercise: Distribution of electrons determines molecular properties (1)	1. Evaluates differences in acidity of ethanol, phenol, and acetic acid. 2. Calculates intramolecular charge distribution. 3. Discusses interactions between molecules.
		10th	Lecture/Exercise: Distribution of electrons determines properties of molecules (2)	1. Explains the effects of solvents. 2. Calculates the change in chemical structure of glycine by solvent. 3. Calculates and explains the function of Grignard reagent.
		11th	Lecture/Exercise: Color of molecules (1)	1. Explains electron correlation. 2. Explains the configuration interaction (CI) method. 3. Calculates excited states and electronic spectra of molecules.
		12th	Exercise: Knowing the color of molecules (2)	1. Draws and modifies molecules with complex structures. 2. Evaluates changes in molecular structure and their effects on electronic spectra. 3. Predicts changes in indicator color by calculation.
		13th	Lecture/Exercise: Predicting chemical reactions (1)	1. Evaluates the stability of carbocations. 2. Evaluate the distribution of frontier orbitals on each atom. 3. Predicts reactivity from the distribution of frontier orbitals.
		14th	Exercise: Predicting chemical reactions (2)	1. Calculates infrared spectra and vibrational modes. 2. Performs TS optimization and IRC calculations for SN2 reactions and predicts the direction of the reaction. 3. Evaluates substituent effects in SN2 reactions.
		15th	Exercise: Predicting chemical reactions (3)	1. Explains frontier orbital theory and Woodward-Hoffman rule. 2. Explains and calculates stereospecificity of electron cyclic reactions. 3. Explains and calculates the endo rule of the Diels-Alder reaction.
		16th	[Return of final exam]	

#### Evaluation Method and Weight (%)

	Examination	Portfolio	Total
Subtotal	70	30	100
Basic Proficiency	35	15	50
Specialized Proficiency	35	15	50

Anan College		Year	2024		Course Title	Environmental Chemistry
Course Information						
Course Code		5596101		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	: 2	
Department		Course of Applied Chemical Engineering		Student Grade	Adv. 1st	
Term		First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials		環境と化学, 萩野ら, 東京化学同人				
Instructor		Ota Naotomo				
Course Objectives						
1. Explain air and water pollution and environmental protection technologies. 2. To be able to explain about climate change and preservation of ozone layer from chemical point of view. 3. To be able to explain about energy and waste recycling in relation to chemistry. 4. To be able to explain the generation of useful compounds by green chemistry and environmental problems related to plastics.						
Rubric						
		Ideal Level	Standard Level		minimum Level	
Achievement 1		Explain in detail about air and water pollution and environmental protection technologies without looking at the material.	Explain air and water pollution and environmental protection technologies without looking at the material.		Explain air and water pollution and environmental protection technologies with reference to materials.	
Achievement 2		To be able to explain in detail about climate change and ozone layer conservation from a chemical point of view without looking at materials.	To be able to explain about climate change and ozone layer conservation from a chemical point of view without looking at materials.		To be able to explain about climate change and ozone layer conservation from a chemical point of view with reference to materials.	
Achievement 3		Explain in detail the relationship between energy and waste recycling and chemistry without looking at materials.	Explain energy and waste recycling in relation to chemistry without looking at materials.		Explain energy and waste recycling in relation to chemistry with reference to materials.	
Achievement 4		To be able to explain in detail the generation of useful compounds by green chemistry and environmental issues related to plastics without looking at materials.	To be able to explain the generation of useful compounds by green chemistry and environmental issues related to plastics without looking at materials.		To be able to explain the generation of useful compounds by green chemistry and environmental issues related to plastics with reference to materials.	
Assigned Department Objectives						
Teaching Method						
Outline		Based on the philosophy of "green chemistry," which is the basis of environmentally friendly manufacturing in the field of chemistry, students learn the relationship between various environmental problems and chemistry, and the class is taught from the viewpoint of how to build an environmentally friendly and sustainable society.				
Style		Students will be given a quiz to check their preparation, presentations by students, and reports (30 hours of class time + 60 hours of self-study time).				
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	What is Green Chemistry?		Can explain the philosophy of green chemistry	
		2nd	Clean air		To be able to explain the formation of the atmosphere, air pollutants and acid rain	
		3rd	Clean air		Explain air pollution trends and countermeasures	
		4th	Valuable water resources		Explain the properties of water and its importance as a resource	
		5th	Valuable water resources		Can explain about water purification and water environment conservation	
		6th	Chemistry of Climate Change		Can explain global warming chemically	
		7th	Chemistry of Climate Change		Explain the current state of climate change due to human activities and global warming countermeasures	
		8th	Protect the Ozone Layer		Explain the function and destruction of the ozone layer	
	2nd Quarter	9th	Protect the Ozone Layer		Explain the function and destruction of the ozone layer	
		10th	Take care of your energy		Can explain about human society and energy	
		11th	Take care of your energy		Can explain about renewable energy	
		12th	Create useful substances		Explain chemical synthesis and greenness	
		13th	Create useful substances		Explain the role of green chemistry in chemical synthesis	
		14th	Polymer Chemistry		Can explain about bioplastics	

		15th	Waste Recycling			To be able to explain about recycling and recycling-oriented society	
		16th					
Evaluation Method and Weight (%)							
	Examination	quiz	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	50	0	0	50	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	0	50	0	0	50	0	100
Cross Area Proficiency	0	0	0	0	0	0	0



Anan College		Year	2024		Course Title	Experiments in Applied Chemistry	
Course Information							
Course Code		5517J01		Course Category		Specialized / Compulsory	
Class Format		Experiment / Practical training		Credits		Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade		Adv. 2nd	
Term		First Semester		Classes per Week		前期:6	
Textbook and/or Teaching Materials		Experiment description designated by each instructor / Bibliography assigned by each instructor					
Instructor		Otani Takashi,Sugiyama Yuuki,Ueda Kohei,Ezure Ryosuke					
Course Objectives							
1. The students will acquire the basic experimental techniques appropriate to the purpose of the experiment and experiment. 2. The students consider the results of experiments and solve problems from an engineering perspective.							
Rubric							
		Ideal Level		Standard Level		Minimum Level	
Objective 1		Acquire basic experimental techniques for each topic and carry out experiments efficiently by applying their unique innovations.		Acquire basic experimental techniques for each topic and carry out experiments.		Acquire a minimum of basic experimental techniques for each topic and carry out experiments.	
Objective 2		Consider the results of experiments from an engineering perspective and solve given not only problems but also problems that they have discovered on their own.		Consider the results of experiments from an engineering perspective, and understand and solve given problems.		Consider the results of the experiment from an engineering point of view and manage to solve the given problem.	
Assigned Department Objectives							
Teaching Method							
Outline		The program's objective is to cultivate the ability to think creatively, find and solve practical problems, and promote complex technological development that leads to "monozukuri" (manufacturing).					
Style		Theme 1: Synthetic Inorganic Material experiment (1-7 weeks) Theme 2: Synthetic organic chemistry experiment (8-15 weeks) [90 hours of class time]					
Notice		One theme will be conducted over 7-8 weeks. During the experiment, students must pay close attention to safety and follow the instructions of the instructor in charge.					
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 type="checkbox"/> Instructor Professionally Experienced	
Course Plan							
			Theme		Goals		
1st Semester	1st Quarter	1st	Theme 1: Synthetic Inorganic Material experiment		(1) Understand how to prepare powder samples by the sol-gel method, and be able to read the experimental section in English and understand the experimental procedure accurately.		
		2nd	Theme 1: Synthetic Inorganic Material experiment		(2) Prepare TiO2 powder by weighing, stirring, and centrifuging.		
		3rd	Theme 1: Synthetic Inorganic Material experiment		(3) Sinter the powder.		
		4th	Theme 1: Synthetic Inorganic Material experiment		(4) Measure the xrd of the powder		
		5th	Theme 1: Synthetic Inorganic Material experiment		(5) FE-SEM observation		
		6th	Theme 1: Synthetic Inorganic Material experiment		(6) FT-IR measurement		
		7th	Theme 1: Synthetic Inorganic Material experiment		(7) Summarize the entire experiment in a report by reflecting on it.		
		8th	Theme 2: Synthetic organic chemistry experiments		(8) Understand the Diels-Alder reaction, read the experimental section in English, and understand the experimental procedure accurately.		
	2nd Quarter	9th	Theme 2: Synthetic organic chemistry experiments		(9) In carrying out the Diels-Alder reaction, cyclopentadiene is distilled.		
		10th	Theme 2: Synthetic organic chemistry experiments		(10) Carry out the Diels-Alder reaction.		
		11th	Theme 2: Synthetic organic chemistry experiments		(11) Purify adducts.		
		12th	Theme 2: Synthetic organic chemistry experiments		(12) Analyze the NMR of the adducts.		
		13th	Theme 2: Synthetic organic chemistry experiments		(13) Determine the steric structure of the adduct.		
		14th	Theme 2: Synthetic organic chemistry experiments		(14) Explain the steric structure and endo rule of adducts using orbital theory.		
		15th	Theme 2: Synthetic organic chemistry experiments		(15) Summarize the entire experiment in a report by reflecting on it.		
		16th					
Evaluation Method and Weight (%)							

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

Anan College		Year	2024		Course Title	Advanced Physical Chemistry	
Course Information							
Course Code		5517Z03		Course Category		Specialized / Compulsory	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade		Adv. 2nd	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		平山令明「はじめての量子化学」講談社ブルーバックス / 染川賢一「有機分子の分子軌道計算と活用」九州大学出版会					
Instructor		Konishi Tomoya					
Course Objectives							
1. Explains the concept and principle of molecular orbital method. 2. Uses molecular orbital calculation software. 3. Discusses various properties and reactions of molecules using molecular orbital calculation.							
Rubric							
		Ideal Level		Standard Level		Acceptable Level	
Achievement 1		Explains the calculation method of molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Explains molecular orbitals.	
Achievement 2		Calculates charge distribution and electron density by molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Calculates molecular conformation by molecular orbital method.	
Achievement 3		Discusses the reactivity of molecules by molecular orbital method.		Discusses the reactivity of molecules by molecular orbital method.		Discusses the stability of molecules by molecular orbital method.	
Assigned Department Objectives							
Teaching Method							
Outline		We have so far learned about the various physical properties exhibited by materials and that "physical properties" are determined by the "composition" and "structure" of a material. Why is that? The key is the Schrödinger's equation $H\psi=E\psi$ . In this lecture, through the molecular orbital method, we will understand that the electronic state of a molecule is determined by its "composition" and "structure," and that physical properties can be explained in principle by them. After reviewing the concept of molecular orbital, specific quantum chemical calculation methods (Hartree-Fock method, variational method, and self-consistency method) will be introduced. Next, students will perform actual molecular orbital calculations on several molecules and discuss their conformation, polarity, acidity, color, reactivity, and so on. As a practical application, students will measure the infrared absorption spectra of organic polymers and compare them with the results calculated by the molecular orbital method.					
Style		Students will learn through lectures and practical training. The laboratory will be conducted in a BYOD style, so bring your own laptop computer and earphones. Hands-on learning will be conducted using molecular structure modeling software and quantum chemical calculation software installed on each student's laptop. The periodic examination will include a practical test on the quantum chemical calculation software.					
Notice		Students are required to read the sections of the textbook related to the contents of each week's class in advance. Syllabus-designated reference book: 藤永茂「入門分子軌道法」講談社					
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 r	1st Quarter	1st	Lecture: The Origin of Atoms		1. Explains atomic structure and electron configuration. 2. Explains wavefunction and Schrödinger equation. 3. Explains quantum numbers and their constitutive principles.		
		2nd	Lecture: From Atoms to Molecules (1)		1. Explains molecular orbitals. 2. Explains how to derive molecular orbitals. 3. Derives molecular orbitals of hydrogen molecules.		
		3rd	Exercise: From Atoms to Molecules (2)		1. Uses quantum chemical calculation software. 2. Calculates molecular orbitals of hydrogen molecules. 3. Displays molecular orbitals of hydrogen molecules.		
		4th	Lecture: What is obtained from molecular orbital method (1)		1. Explains many-body problems. 2. Explains Hartree equation. 3. Explains variational and self-consistency methods.		
		5th	Exercise: What we can obtain from molecular orbital method (2)		1. Calculate the conformation of ethane. 2. Calculates molecular orbitals of ethane. 3. Calculates electron density and heat of formation of ethane.		
		6th	Lecture: What is required from Molecular Orbital Method (3)		1. Explains Slater determinant and Hartree-Fock equation. 2. Explains the LCAO approximation and the Hartree-Fock-Roothaan equation. 3. Explains the difference between non-empirical and semi-empirical molecular orbital methods.		
		7th	Exercise: Knowing the structure of molecules (1)		1. Explains the Z-matrix. 2. Performs structural optimization calculations and explains the delocalization of pi electrons by structural optimization calculation. 3. Performs conformational analysis of molecules.		

		8th	Lecture/Exercise: Knowing the Structure of Molecules (2)	1. Calculates heat of formation of a molecule and discusses its stability 2. Calculates orbital energy of molecules and discusses reactivity. 3. Calculate electrostatic potential of molecules and discusses polarity.
	2nd Quarter	9th	Lecture/Exercise: Distribution of electrons determines molecular properties (1)	1. Evaluates differences in acidity of ethanol, phenol, and acetic acid. 2. Calculates intramolecular charge distribution. 3. Discusses interactions between molecules.
		10th	Lecture/Exercise: Distribution of electrons determines properties of molecules (2)	1. Explains the effects of solvents. 2. Calculates the change in chemical structure of glycine by solvent. 3. Calculates and explains the function of Grignard reagent.
		11th	Lecture/Exercise: Color of molecules (1)	1. Explains electron correlation. 2. Explains the configuration interaction (CI) method. 3. Calculates excited states and electronic spectra of molecules.
		12th	Exercise: Knowing the color of molecules (2)	1. Draws and modifies molecules with complex structures. 2. Evaluates changes in molecular structure and their effects on electronic spectra. 3. Predicts changes in indicator color by calculation.
		13th	Lecture/Exercise: Predicting chemical reactions (1)	1. Evaluates the stability of carbocations. 2. Evaluate the distribution of frontier orbitals on each atom. 3. Predicts reactivity from the distribution of frontier orbitals.
		14th	Exercise: Predicting chemical reactions (2)	1. Calculates infrared spectra and vibrational modes. 2. Performs TS optimization and IRC calculations for SN2 reactions and predicts the direction of the reaction. 3. Evaluates substituent effects in SN2 reactions.
		15th	Exercise: Predicting chemical reactions (3)	1. Explains frontier orbital theory and Woodward-Hoffman rule. 2. Explains and calculates stereospecificity of electron cyclic reactions. 3. Explains and calculates the endo rule of the Diels-Alder reaction.
		16th	[Return of final exam]	

#### Evaluation Method and Weight (%)

	Examination	Portfolio	Total
Subtotal	70	30	100
Basic Proficiency	35	15	50
Specialized Proficiency	35	15	50

Anan College		Year	2024		Course Title	Environmental Chemistry
Course Information						
Course Code		5597101		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade	Adv. 2nd	
Term		First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials		環境と化学, 萩野ら, 東京化学同人				
Instructor		Ota Naotomo				
Course Objectives						
1. Explain air and water pollution and environmental protection technologies. 2. To be able to explain about climate change and preservation of ozone layer from chemical point of view. 3. To be able to explain about energy and waste recycling in relation to chemistry. 4. To be able to explain the generation of useful compounds by green chemistry and environmental problems related to plastics.						
Rubric						
		Ideal Level	Standard Level		minimum Level	
Achievement 1		Explain in detail about air and water pollution and environmental protection technologies without looking at the material.	Explain air and water pollution and environmental protection technologies without looking at the material.		Explain air and water pollution and environmental protection technologies with reference to materials.	
Achievement 2		To be able to explain in detail about climate change and ozone layer conservation from a chemical point of view without looking at materials.	To be able to explain about climate change and ozone layer conservation from a chemical point of view without looking at materials.		To be able to explain about climate change and ozone layer conservation from a chemical point of view with reference to materials.	
Achievement 3		Explain in detail the relationship between energy and waste recycling and chemistry without looking at materials.	Explain energy and waste recycling in relation to chemistry without looking at materials.		Explain energy and waste recycling in relation to chemistry with reference to materials.	
Achievement 4		To be able to explain in detail the generation of useful compounds by green chemistry and environmental issues related to plastics without looking at materials.	To be able to explain the generation of useful compounds by green chemistry and environmental issues related to plastics without looking at materials.		To be able to explain the generation of useful compounds by green chemistry and environmental issues related to plastics with reference to materials.	
Assigned Department Objectives						
Teaching Method						
Outline		Based on the philosophy of "green chemistry," which is the basis of environmentally friendly manufacturing in the field of chemistry, students learn the relationship between various environmental problems and chemistry, and the class is taught from the viewpoint of how to build an environmentally friendly and sustainable society.				
Style		Students will be given a quiz to check their preparation, presentations by students, and reports (30 hours of class time + 60 hours of self-study time).				
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	What is Green Chemistry?		Can explain the philosophy of green chemistry	
		2nd	Clean air		To be able to explain the formation of the atmosphere, air pollutants and acid rain	
		3rd	Clean air		Explain air pollution trends and countermeasures	
		4th	Valuable water resources		Explain the properties of water and its importance as a resource	
		5th	Valuable water resources		Can explain about water purification and water environment conservation	
		6th	Chemistry of Climate Change		Can explain global warming chemically	
		7th	Chemistry of Climate Change		Explain the current state of climate change due to human activities and global warming countermeasures	
		8th	Protect the Ozone Layer		Explain the function and destruction of the ozone layer	
	2nd Quarter	9th	Protect the Ozone Layer		Explain the function and destruction of the ozone layer	
		10th	Take care of your energy		Can explain about human society and energy	
		11th	Take care of your energy		Can explain about renewable energy	
		12th	Create useful substances		Explain chemical synthesis and greenness	
		13th	Create useful substances		Explain the role of green chemistry in chemical synthesis	
		14th	Polymer Chemistry		Can explain about bioplastics	

		15th	Waste Recycling			To be able to explain about recycling and recycling-oriented society	
		16th					
Evaluation Method and Weight (%)							
	Examination	quiz	Mutual Evaluations between students	Behavior	Portfolio	Other	Total
Subtotal	0	50	0	0	50	0	100
Basic Proficiency	0	0	0	0	0	0	0
Specialized Proficiency	0	50	0	0	50	0	100
Cross Area Proficiency	0	0	0	0	0	0	0

Anan College		Year	2024	Course Title	Composite Materials
Course Information					
Course Code	5597C04		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Applied Chemical Engineering		Student Grade	Adv. 2nd	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	FRP Basics (KORONA PUBLISHING CO., LTD)				
Instructor	Kadono Takuma				
Course Objectives					
1. Able to understand the knowledge and technology related to various composite materials and explain their basics. 2. Able to understand the definition, uses, materials, molding methods, characteristics, and design methods of FRP (fiber reinforced plastics), and explain their basics. 3. Able to understand the knowledge and technology related to high-performance and multi-functional concrete using various reinforcing materials and admixtures, and explain the basics.					
Rubric					
	Ideal Level		Standard Level		Minimum Level
Achievement 1	Able to understand the knowledge and technology of various composite materials, and explain the basics, pose problems, and make suggestions regarding them.		Able to understand the knowledge and technology of various composite materials and explain the basics about them.		Able to explain the basics of knowledge and technology for various composite materials.
Achievement 2	Able to understand definitions, uses, materials, molding methods, characteristics and design methods related to FRP, and explain the basics, pose problems, and make suggestions regarding them.		Able to understand the definitions, uses, materials, molding methods, characteristics and design methods of FRP, and explain their basics.		Able to explain the basics of FRP definitions, applications, materials, molding methods, properties and design methods.
Achievement 3	Able to understand the knowledge and technology of concrete that can be made high performance and multifunctional with various reinforcing materials and admixtures, and explain the basics, raise problems, and make proposals regarding them.		Able to understand the knowledge and technology of concrete that can be made high performance and multi-functional with various reinforcing materials and admixtures, and explain the basic matters related to them.		Able to explain the basics of knowledge and technology related to concrete, which can be enhanced and multifunctional with various reinforcing materials and admixtures.
Assigned Department Objectives					
Teaching Method					
Outline	The students of this course will can learn various composite materials used as structural materials and functional materials, FRP that is a composite material with a wide range of applications, and concrete that uses various materials to improve performance and increase functionality. The students of this course will will be able to acquire knowledge and skills regarding the materials used, molding methods, properties, design methods, and applications, and improve your technical skills in design, construction, and maintenance that are suitable for society and the environment.				
Style	【31 class hours + final exam + 60 self-study hours】 Since this course is a credit course, it is necessary to submit assignments for pre- and post-learning.				
Notice	This subject is included in Group V of Specialized Fields, which is a requirement for completing the JABBE-accredited Creative Technology System Engineering program. This class is a lecture that uses textbooks, handouts, videos, etc., so please do not miss class. Concrete, the most widely used industrial material in the world, is a classic and cutting-edge composite material. Before participating in these concrete classes, please use the textbooks on construction materials and concrete structures in the construction course and understand the basics in advance.				
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 / Various composite materials	Able to understand the objectives, significance, plans, precautions, etc. of the class, and explain them. / Able to describe types of composite materials, materials used, molding methods, properties, design methods, applications, etc.	
		2nd	Various composite materials	Able to describe types of composite materials, materials used, molding methods, properties, design methods, applications, etc.	
		3rd	Various composite materials	Able to describe types of composite materials, materials used, molding methods, properties, design methods, applications, etc.	
		4th	Various composite materials	Able to describe types of composite materials, materials used, molding methods, properties, design methods, applications, etc.	

		5th	Various composite materials	Able to describe types of composite materials, materials used, molding methods, properties, design methods, applications, etc.
		6th	FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
		7th	FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
		8th	FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
	2nd Quarter	9th	Midterm exam	
		10th	Return of exam papers / FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
		11th	FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
		12th	FRP	Able to explain the definition of FRP, use, material, molding method, characteristics, design method, etc.
		13th	High Performance Concrete / Multifunctional Concrete	Able to explain the types, characteristics, and uses of various reinforcing materials and admixtures for concrete, and explain the characteristics and applications of high-performance concrete and multifunctional concrete using these.
		14th	High Performance Concrete / Multifunctional Concrete	Able to explain the types, characteristics, and uses of various reinforcing materials and admixtures for concrete, and explain the characteristics and applications of high-performance concrete and multifunctional concrete using these.
		15th	High Performance Concrete / Multifunctional Concrete	Able to explain the types, characteristics, and uses of various reinforcing materials and admixtures for concrete, and explain the characteristics and applications of high-performance concrete and multifunctional concrete using these.
		16th	(Final exam) Return of exam papers	

#### Evaluation Method and Weight (%)

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



Anan College		Year	2024	Course Title	Mathematics of Electronics and Information
Course Information					
Course Code	5597E02		Course Category	Specialized / Elective	
Class Format	Lecture		Credits	Academic Credit: 2	
Department	Course of Applied Chemical Engineering		Student Grade	Adv. 2nd	
Term	First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials	Enshu to Ouyo Bibunhouteishiki, Saiensu Sha				
Instructor	Sugino Ryuzaburo				
Course Objectives					
1. We can understand Furier series and its transformation, and compute of its fundamental computation. 2. We can understand Laplace transformation and operational calsulul, and compute of its fundamental computaion. 3. We can understand the construction method of differential equation , and compute of its fundamental problems.					
Rubric					
		Ideal Level	Standard Level	Unacceptable Level	
Achievement 1		We can understand Fourier series an its tranformations and apply these for the various problems.	We can understand Fourier series an its tranformations and compute these for the fundamental problems.	We can understand Fourier series an its tranformations, and compute of its elementary problems.	
Achievement 2		We can understand Laplace transformations and the operation method and apply these for the fundamental problems.	We can understand Laplace transformations and the operation method and compute the fundamental problems.	We can understand understand Laplace transformations and the operation method and compute of its elementary problems.	
Achievement 3		We can understand the construction method of differentail equation and apply these for the fundamental problems.	We can understand the construction method of differentail equation and compute the fundamental problems.	We can understand the construction method of differentail equation and compute of its elementary problems.	
Assigned Department Objectives					
Teaching Method					
Outline	We are to make a concentration for our class and use the knowledges and techniques about basic mathematics to construction of understanding of Fourier and Laplace transeformation and building up the solutions of ordinary and partial differential equations.				
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.				
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	Fourier Series	We can understand Fourier series and compute its fundamental problems.	
		2nd	Fourier Series	We can understand the applications of Fourier series and compute its fundamental problems.	
		3rd	Fourier Series	We can understand complex Fourier series and compute its fundamental problems.	
		4th	Fourier Series	We can understand Fourier transeformation and compute its fundamental problems.	
		5th	Fourier Series	We can understand Fourier intergrals and compute its fundamental problems.	
		6th	Fourier Analysis	We can understand the frequency analysis using Fourier transeformation and compute its fundamental problems.	
		7th	Fourier Analysis	We can understand the Fourier analysis of differential equation and compute its fundamental problems.	
		8th	Mid-term examination		
	2nd Quarter	9th	Laplace Transeformation	We can understand Laplace transeformation and compute its fundamental problems.	
		10th	Laplace Transeformation	We can understand the applications of Laplace transformation and compute its fundamental problems.	
		11th	Laplace Transeformation	We can understand the basis and dimension of subspace and compute its fundamental problems.	
		12th	Differential Equation and Its Function Space	We can understand the linear mapping of vector space and compute its fundamental problems.	

		13th	Differential Equation and Its Function Space	We can understand the change of basis and representation matrix and compute its fundamental problems.
		14th	The Solutions of Partial Differential Equation	We can understand the construction method of partial differential equation and explain of it.
		15th	The Solutions of Partial Differential Equation	We can compute the fundamental applied problems using construction method of partial differential equation's solutions.
		16th	Final examination	

#### 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	10	0	30
Cross Area Proficiency	10	0	0	0	10	0	20

Anan College		Year	2024		Course Title	Semiconductor Material Properties
Course Information						
Course Code		5597E04		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade	Adv. 2nd	
Term		Second Semester		Classes per Week	後期:2	
Textbook and/or Teaching Materials		電子物性 松澤・高橋・斉藤 共著（森北出版）				
Instructor		Hasegawa Tatsuo				
Course Objectives						
1. 固体のバンド構造について説明できる。 2. 半導体中のキャリア密度の温度変化について説明できる。 3. 3種類の電気分極の機構について説明できる。 4. 磁性の発現機構について説明できる。						
Rubric						
		理想的な到達レベル(優)		標準的な到達レベル(良)		最低限の到達レベル(可)
到達目標1		固体のバンド構造について説明でき、フロッホの定理を用いてその電子状態を記述することができる。		固体のバンド構造を、周期ポテンシャルと関連付けて説明できる。		固体のバンド構造に関する考え方を理解することができる。
到達目標2		真性半導体と不純物半導体のキャリア密度の温度変化について、フェルミ分布関数を用いて説明できる。		真性半導体と不純物半導体のキャリア密度の温度変化について、定性的な説明をすることができる。		半導体中のキャリアに関する考え方を理解することができる。
到達目標3		3種類の電気分極の機構について、定量的な説明をすることができる。		3種類の電気分極の機構について、定性的な説明をすることができる。		電気分極に関する考え方を理解することができる。
到達目標4		原子の磁気モーメントや伝導電子を考慮して、磁性の発現機構について定量的に説明できる。		磁性の発現機構について、定性的な説明をすることができる。		磁性に関する考え方を理解することができる。
Assigned Department Objectives						
Teaching Method						
Outline		身の回りの様々な物質、また製造業で使われる材料が示す物理的・化学的な諸物性のほとんどは、物質中の電子の振る舞いに起因したものである。本講義は量子力学を出発点として、最も基本的な性質について述べていき、将来のより発展した学修のための基礎を身に付けることを目的としている。なお、この科目は企業で半導体の要素技術の開発を担当していた教員が、その経験を活かし、様々な物質の特性について講義形式で授業を行うものである。				
Style		講義形式で授業を行っていく。内容としては、先ず量子力学の基礎的な事柄を学んだ後、エネルギーバンド構造と半導体を学び、その後誘電体、磁性体へと進んでいく。この科目は学修単位科目のため、事前事後学習としてレポート等を実施します 【授業時間30時間+自学自習時間60時間】				
Notice		本講義を履修するためには、微分方程式や線形代数に関する知識が不可欠です。また、内容が多いため、講義中に演習問題を解く時間が無く、演習は課題として提出してもらいます。内容の理解のために、課題は他の多くの書物を参照して、自分で解決してください。				
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	物質の粒子性と波動性、不確定性原理	物質の粒子性と波動性、及び不確定性原理について説明できる。		
		2nd	井戸型ポテンシャルの波動関数	1次元井戸型ポテンシャルにおけるシュレーディンガー方程式の解を求めることができる。		
		3rd	トンネル効果	1次元系において、矩形のポテンシャル障壁におけるトンネル確率を求めることができる。		
		4th	水素原子のエネルギー準位	クーロンポテンシャルにおけるシュレーディンガー方程式の解が、3つの量子数で表されることを理解できる。		
		5th	金属の自由電子論	変数分離法により、3次元系の自由電子の波動関数、及び状態密度を求めることができる。		
		6th	フェルミ・ディラック分布関数	フェルミ・ディラック分布関数について説明できる。		
		7th	金属の電子密度分布とフェルミレベル	電子密度とフェルミレベル、フェルミ波数、フェルミ温度との関係を導くことができる。		
		8th	中間試験			
	4th Quarter	9th	周期ポテンシャルにおけるエネルギー分散	クローニツヒ・ペニーのモデルにおけるエネルギー分散の様子について理解できる。		
		10th	結晶内における電子の運動とバンド理論	効質量、及びバンド理論の考え方について理解できる。		
		11th	真性半導体	電子密度・正孔密度の温度依存性を導出できる。		
		12th	不純物半導体	n型・p型半導体の特徴について説明できる。		
		13th	誘電体	電子分極、イオン分極、配向分極について理解できる。		

		14th	原子の磁気モーメント	軌道磁気モーメントとスピン磁気モーメントについて説明できる。
		15th	磁性体の分類	常磁性、反磁性、強磁性、反強磁性の特徴について理解できる。
		16th	期末試験返却	

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	その他	Total
Subtotal	60	0	40	0	0	100
基礎的能力	20	0	10	0	0	30
専門的能力	40	0	30	0	0	70
分野横断的能力	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Signal Processing Engineering
Course Information						
Course Code		5597I03		Course Category	Specialized / Elective	
Class Format		Lecture		Credits	Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade	Adv. 2nd	
Term		First Semester		Classes per Week	前期:2	
Textbook and/or Teaching Materials		信号処理入門（オーム社）				
Instructor		Yasuno Emiko				
Course Objectives						
1. アナログ信号とデジタル信号について、基本的事項を理解し、説明できる。 2. 相関関数の定義を理解し、簡単な計算ができる。 3. フーリエ級数展開の基本事項を理解し、基本的な関数のフーリエ級数展開ができる。 4. フーリエ変換の定義を理解し、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		最低限の到達レベルの目安(可)
到達目標1		アナログ信号とデジタル信号について説明でき、実際の問題に適用できる。		アナログ信号とデジタル信号について、説明できる。		アナログ信号とデジタル信号について、基本的事項を理解し、説明できる。
到達目標2		相関関数の定義を理解し、簡単な計算ができ、課題解決に応用できる。		相関関数の定義を理解し、計算ができる。		相関関数の定義を理解し、簡単な計算ができる。
到達目標3		フーリエ級数展開を理解し、フーリエ級数展開ができる。		フーリエ級数展開の理解し、基本的な関数のフーリエ級数展開ができる。		フーリエ級数展開の基本事項を理解し、基本的な関数のフーリエ級数展開ができる。
到達目標4		フーリエ変換の定義を理解し、課題解決に応用できる。		フーリエ変換の定義を理解し、説明できる。		フーリエ変換の定義を説明できる。
Assigned Department Objectives						
Teaching Method						
Outline		自然現象には不規則に変動するものがきわめて多い。本講義では、そこに埋もれている信号の性質を解析したり、抽出処理するための基礎的信号処理技法を修得することを目標とする。				
Style		授業は講義形式で行います。授業を受ける際には、予習と復習をしたうえで授業に臨むと理解が深まります。 【授業時間31時間＋自学自習時間60時間】 この科目は学修単位科目のため、事前・事後学修としてレポート等を実施します。				
Notice		単に講義を受講するだけでなく、レポート等の演習にも積極的に取り組んでください。				
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	信号処理とは ・信号の種類 ・アナログ信号とデジタル信号 ・サンプリング問題		アナログ信号とデジタル信号について説明できる。	
		2nd	信号処理の例 ・波形の平滑化 ・雑音の圧縮		波形の平滑化、雑音の圧縮について説明できる。	
		3rd	数学の準備体操 ・信号の表現		正規直交基について正しく理解し、計算によって値を求めることができる。	
		4th	・多次元ベクトル空間から関数空間へ		多次元ベクトル空間から関数空間への拡張について理解できる。	
		5th	・正規直交関数系		正規直交関数形について正しく理解し、計算によって値を求めることができる。	
		6th	相関関数 ・正規直交関数系関数の類似性 ・相互相関関数		相互相関関数について正しく理解し、計算によって値を求めることができる。	
		7th	・自己相関関数		自己相関関数について正しく理解し、計算によって値を求めることができる。	
		8th	演習		演習問題を解くことができる。	
	2nd Quarter	9th	中間試験			
		10th	フーリエ級数展開 ・フーリエ級数展開とは		フーリエ級数展開について理解し、与えられた式を展開することができる。	
		11th	・偶関数と奇関数 ・周期が2πでない場合		偶関数と奇関数について説明できる。	
		12th	・複素フーリエ級数展開を導く		複素フーリエ級数展開を導くことができる。	
		13th	・フーリエ級数展開の実例 ・パーシバルの定理		フーリエ級数展開の実例について理解し、説明と計算ができる。	
		14th	・フーリエ級数展開の重要な性質		フーリエ級数展開の重要な性質について理解し、説明できる。	

		15th	フーリエ変換 ・フーリエ級数展開からフーリエ変換へ ・フーリエ変換の性質		フーリエ変換の性質について理解し、説明できる。	
		16th	答案返却			
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	その他	Total
Subtotal	70	0	30	0	0	100
基礎的能力	30	0	15	0	0	45
専門的能力	40	0	15	0	0	55
分野横断的能力	0	0	0	0	0	0

Anan College		Year	2024		Course Title	Strength and Fracture of Materials	
Course Information							
Course Code		5597M02		Course Category		Specialized / Elective	
Class Format		Lecture		Credits		Academic Credit: 2	
Department		Course of Applied Chemical Engineering		Student Grade		Adv. 2nd	
Term		First Semester		Classes per Week		前期:2	
Textbook and/or Teaching Materials		金属の強度と破壊 P O D 版（森北出版）/百万人の金属学（アグネ技術センター）、材料の科学と工学 1～4（培風館）					
Instructor		Okumoto Yoshihiro					
Course Objectives							
1. 弾性変形と塑性変形が区別でき、説明できる。 2. 金属の理論的強度について概算できる。 3. 金属の破壊現象について説明できる。							
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		最低限の到達レベルの目安(可)	
到達目標1		弾性変形と塑性変形が区別でき、図表等を作成し説明する。		弾性変形と塑性変形が区別でき、口頭で説明できる。		弾性変形と塑性変形が区別できる。	
到達目標2		金属の理論的強度を考える際のモデリングが理解でき、概算できる。		金属の理論的強度を考える際のモデリングが理解でき、口頭で説明できる。		金属の理論的強度を考える際のモデリングが理解できい。	
到達目標3		金属の破壊現象について、具体例を与えられたときに解析できる。		金属の破壊現象について、理解した上で、分類・説明できる。		金属の破壊現象について理解できない。	
Assigned Department Objectives							
Teaching Method							
Outline		本講義では材料の強さに着目し、原子レベルでのミクロな視点から材料の破壊現象を読み取る力を養成する。なお、本講義で対象とする材料は金属に限定する。					
Style		教科書にしたがって講義を進めていきます。必要な計算問題等については追加します。講義でやりきれなかった内容についてはmanabaを使って伝達します。 【授業時間30時間＋自学自習時間60時間】					
Notice		化学、材料工学を今まで学んできて、材料学と物質の強さとの結びつきについてまとめて考える機会がなかったかもしれない。材料の微視的構造を考慮に入れて材料の破壊の原理について学ぶことは必ずや物質の強度を理解する際に役立つと思われる。なお、基本的な力学的項目は本科で学んでいるものとして進めていく。					
Characteristics of Class / Division in Learning							
<input checked="" 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 r	1st Quarter	1st	0.講義ガイダンス		金属についてこれまで学んできたことを整理できる。		
		2nd	1.]原子結合から見た弾性変形		弾性変形の微視的モデルを理解できる。		
		3rd	2.破壊力学概説 理論的引張り強さ		理論的引張り強さの導出過程を理解できる。		
		4th	2.破壊力学概説 破壊靱性（1）		破壊靱性の概念を理解できる。		
		5th	2.破壊力学概説 破壊靱性（2）		破壊靱性の概念を理解できる。		
		6th	2.破壊力学概説 破壊靱性（3）		破壊靱性の測定方法が理解できる。		
		7th	3.疲労破壊		BCC金属における疲労破壊現象が理解できる。		
		8th	中間試験		60点以上		
	2nd Quarter	9th	4.金属の塑性変形 理論的せん断強さ		理論的せん断強さの導出過程を理解できる。		
		10th	4.金属の塑性変形 転位論の導入		転位の存在が理解できる。		
		11th	5.塑性変形における温度の影響（1）		活性化エネルギーの概念が理解できる。		
		12th	5.塑性変形における温度の影響（2）		クリープ寿命が計算できる。		
		13th	6.固体内の拡散		拡散の法則に基づく計算ができる。		
		14th	7.金属の強化メカニズム（1）		加工硬化と固溶強化が理解できる。		
		15th	7.金属の強化メカニズム（2）		マルテンサイト変態強化が理解できる。		
		16th	期末試験の返却		－		
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	その他	Total	
Subtotal	70	20	10	0	0	100	
基礎的能力	0	0	0	0	0	0	
専門的能力	70	20	10	0	0	100	
分野横断的能力	0	0	0	0	0	0	