		[Title]		[Instructor]			
	Adv	anced Instrumental Analysis IA	Jı Ch	unji Yamana iiaya Yaman	ka 10to		
[Code]	[Credits]	[Program]	[Semester]	[Language of instruction]			
GTI501	1	For All Programs of "Division of Engineering"	Intensive	/	English/ Japanese		
[Outline an	d purpose]						
We will lear	rn practical	knowledge how to operate Transmission Electron	Microscopes (ГЕМ).			
[Objectives]							
First, we wi Then we wi	ill learn ab ll learn hov	out basic mechanical structure of TEM. v to operate the TEM in the "Center for Instrumen"	tal Analysis."				
[Requireme	ents]						
1 (Mandato 2 (Mandato 3 (Mandato 4 (Mandato Analysis." 5 (Optional	ry): Comple ry): Comple ry): Comple ory): Comple ory): Your): If you ha	etion of undergraduate course covering basic physic etion of undergraduate course covering basic chemi etion of undergraduate course of laboratory class al supervisor must agree that you will use the Th we a specific purpose to use TEM for your thesis, it	cs. stry. bout science/en EMs in the " will be desiral	ngineering. Center for ble.	Instrumental		
[Evaluation	ı]						
Quizzes and Practical Sl	d /or Report kills Exami	ts: 50% nation: 50%					
[Textbooks]							
[References	5]						
[Schedule]							
 What can we do using Transmission Electron Microscope (TEM)? Principle of Transmission Electron Microscopy. Basic Mechanical Structure of TEM. How to check the condition of TEM in the "Center for Instrumental Analysis." Specimen Preparation and TEM Operation. Part 1. Specimen preparation and TEM operation. Part 2. Specimen preparation and TEM operation. Part 3. Data Analysis. Part 1. Data Analysis. Part 2. Discussion and Summary. 							
*: It is requ Instrument	*: It is required to receive the credit of this class in advance if you would like to use the TEMs in the "Center for Instrumental Analysis."						
*: If you all to receive t	*: If you already have the credit of the "Instrumental Analysis 1A", which is for undergraduate, you don't have to receive this credit to use the TEMs in the "Center for Instrumental Analysis."						
*: There ar which part	e many op should be l	tions how to prepare the TEM specimens and how earned precisely, at the beginning of this class.	w to operate t	he TEM. W	e can discuss		

		[Title]	[Instructor]			
Advanced Instrumental Analysis IB		Ichiro Fujii Junji Yamanaka Satoki Shinozuka Masayo Katsumata Chiaya Yamamoto Byunosuke Kawamura				
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]	
GTI502	1	For All Programs of "Division of Engineering"	Intensive Course	/	English⁄ Japanese	
[Outline an	d purpose]					
We will leas	rn practica	l knowledge how to operate Scanning Electron M	licroscopes (SEM).		
[Objectives]					
First, we w	ill learn ab	out basic mechanical structure of SEM.				
Then we wi	ill learn ho	w to operate the SEM in the "Center for Instrum	ental Analysis."			
[Requireme	ents]					
1 (Mandato 2 (Mandato 3 (Mandato 4 (Mandato Analysis." 5 (Optional	ory): Compl ory): Compl ory): Compl ory): Your): If you ha	etion of undergraduate course covering basic phy etion of undergraduate course covering basic che etion of undergraduate course of laboratory class supervisor must agree that you will use the ve a specific purpose to use SEM for your thesis,	vsics. mistry. a about science/en SEMs in the " it will be desiral	ngineering. Center for ole.	Instrumental	
[Evaluation	n]					
Quizzes an Practical S	d /or Repor kills Exami	ts: 50% nation: 50%				
[Textbooks]	[Textbooks]					
[References	[References]					
[Schedule]						

- 1. What can we do using Scanning Electron Microscope (SEM)?
- 2. Principle of Scanning Electron Microscopy.
- 3. Basic Mechanical Structure of SEM.
- 4. How to check the condition of SEM in the "Center for Instrumental Analysis."
- 5. Specimen Preparation and SEM Operation. Part 1.
- 6. Specimen preparation and SEM operation. Part 2.
- 7. Specimen preparation and SEM operation. Part 3.
- 8. Data Analysis. Part 1.
- 9. Data Analysis. Part 2.
- 10. Discussion and Summary.

*: It is required to receive the credit of this class in advance if you would like to use the SEMs in the "Center for Instrumental Analysis."

*: If you already have the credit of the "Instrumental Analysis 1B", which is for undergraduate, you don't have to receive this credit to use the SEMs in the "Center for Instrumental Analysis."

*: There are many options how to prepare the SEM specimens and how to operate the SEM. We can discuss which part should be learned precisely, at the beginning of this class.

		[Title]	[Instructor]					
	Advar	nced Instrumental Analysis IC	Sate Sate	oshi Watauc oki Shinozuk	hi xa			
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]			
GTI503	1	For All Programs of "Division of Engineering'	' Intensive	/	English/ Japanese			
[Outline an	d purpose]							
An electroscop After und observation	ron probe e. EPMA erstanding a, X-ray qua	microanalyzer (EPMA) is composed of a scar is useful for compositional analysis of solid surfa- the principle and feature of EPMA, the measu- alitative analysis and quantitative analysis is ac	nning electron n ace with microme arement techniqu quired.	nicroscope a eter to centin ue of electro	und an X-ray neter size. on microscope			
[Objectives]							
 Understa Masterin Masterin Masterin 	anding prin g measure g measure g measure	ciple and feature of EPMA ment technique of electron microscope observation ment technique of X-ray qualitative analysis ment technique of X-ray quantitative analysis	on					
[Requireme	ents]							
Understand	ling X-ray (diffraction method and spectroscopy						
[Evaluation	1							
brief exami	nation & h	omework: 50%						
practice ski	11:50%							
[Textbooks]								
[References	5]							
[Schedule]								
1. Purpose 2. Principle 3. Principle 4. Mainten	[Schedule] 1. Purpose of measurement 2. Principle of EPMA measurement 3. Principle of EPMA analyzer 4. Maintenance of EPMA							
5. Observat 6. Operatio 7. Operatio 8. Data ana 9. Data ana	 5. Observation of scanning electron microscope (sample preparation and microscope operation) 6. Operation of X-ray qualitative analysis 7. Operation of X-ray quantitative analysis 8. Data analysis I (basic) 9. Data analysis I (combination) 							
10. Summa	ry	P110001011/						
*1 You shou **2 If you h	uld get 1 cre ave alread	edit for this class to use EPMA. y gotten 1 credit for this class in undergraduate.	, you do not take	this class.				

	[Title]					
	Adv	anced Instrumental Analysis ID	Sa	Tetsuya Sat toki Shinozu	o 1ka	
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]	
GTI504	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese	
[Outline an X-ray pho because it : XPS is true than ~15	d purpose] toelectron is capable e surface a Å deep. A	spectroscopy (XPS) is useful for chemical character of readily providing information on the nature of nalytical techniques, since the detection electrons fter understanding the principle and measurement	cterization of chemical bons are emitted technique of	thin films ding and va from surfac XPS, qualita	and surfaces alence states. ce layers less ative analysis	
and quantit	tative analy	vsis is acquired.	-			
1. Understa 2. Masterin 3. Masterin	nding prin g measure g Analysis	ciple of X-ray photoelectron spectroscopy. ment technique of X-ray photoelectron spectromete of XPS spectra.	r.			
[Requireme Understand	ents] ling the fur	ndamental of ultrahigh vacuum and electron spectr	oscopy technic	ques.		
[Evaluation brief exami practice ski [Textbooks]	[Evaluation] brief examination & homework: 50% practice skill : 50% [Textbooks]					
References	.]					
Intererences	2					
[Schedule] 1. Purpose of 2. Principle 3. Principle 4. Maintena 5. Operation 6. Operation 7. Data ana 8. Data ana 9. Summary *1 You show **2 If you h	of measure of XPS me of XPS and ance of XPS n of XPS ec n of sputter lysis I (Qu lysis II (Qu y uld get 1 created	ment asurement alyzer 5 juipment (sample preparation,) r depth profiling. alitative analysis) antitative analysis) edit for this class to use XPS. y gotten 1 credit for this class in undergraduate, yo	u do not take	this class.		

		[Title]		[Instructor]]		
				Eiichi Kondoh			
Advanced Instrumental Analysis IE			Satoki Shinozuka				
				Kosuke Har	a		
[Code]	[Credits]	[Program]	[Semester] [Hours] [Language instruction				
GTI505	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese		
[Outline an	d purpose]						
Learn the the instrum	principles ient.	of Auger electron spectroscopy and the actual con	figuration an	d operation	techniques of		
[Objectives]							
(1) To unde	erstand the	principle and features of Auger electron spectrosco	ру.				
(2) To be al	ole to obtai	n information from spectra.					
(3) To unde	erstand the	principles of point analysis, line analysis, and plan	ie analysis.				
(4) To unde	erstand the	actual configuration and operation techniques of the	ne equipment				
[Requireme	ents]						
Knowledge	of physical	chemistry, condensed matter physics, and solid-sta	te physics.				
[Evaluation	l]						
Attitude of	active part	icipation: 50%					
To evaluate	whether o	r not the student has acquired the ability to safely	and correctly	obtain data	by operating		
the Auger e	lectron spe	ctroscopy at the Center for Instrument Analysis an	d understand	the meanin	g: 50%		
[Textbooks]							
[References]						
[Schedule]							
• Principle	s and featu	res of auger electron spectroscopy					
• How to re	ead spectra	and their meanings					
• Principle	s of point a	nalysis, line analysis, and plane analysis					
• Actual eq	uipment co	onfiguration and operation techniques (hands-on pr	actice)				

		[Title]		[Instructor]	
	Adv	anced Instrumental Analysis IF	1	Eiichi Kondo	h
[Code]	[Credits]	[Program]	[Semester] [Hours] [Language instruction		
GTI506	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese
[Outline an	d purpose]				
A high-pre	ecision sha	pe property measurement system consists of seve	ral devices, s	uch as (1) 3	3D coordinate
measureme	ent unit, (2	2) cylindrical shape measuring unit, (3) 3D rou	ghness meas	urement un	it, (4) strain
measuring	instrumen	t, (5) nano-indenter, (6) color laser microscope,	and (7) co	mpact univ	ersal testing
machine. T	his course	will cover the overall structure of the system, as	s well as the	principles,	features, and
operation o	f the instru	ments. Note that lectures will not be given on disca	arded equipme	ent at the tir	ne of lecture.
[Objectives]					
Learn what	kind of hig	gh-precision shape property measurement systems a	are available,	how they dif	fer from each
other, and u	understand	the principles, features, and operation of the devic	es.		
[Requireme	ents]				
Knowledge	of materia	ls			
[Evaluation	ı]				
Attitude of	active part	icipation: 50%			
To evaluate	whether o	r not the student has acquired the ability to safely	and correctly	obtain data	by operating
the system	and unders	stand the meaning of the data: 50%			
[Textbooks]					
[References]				
[Schedule]					
The princip	le, configu	ration, features, and operation of each high-precisio	n shape prope	erty measure	ement system
will be expl	ained.				

[Title]				[Instructor]	
Advanced Instrumental Analysis IG			Tsu Ma Sa Ch Ryun	tomu Murar sayo Katsun toki Shinozu iaya Yamam osuke Kawa	naka nata ika noto imura
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
GTI507	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese
[Outline an	d purpose]				
Liquid nit liquid nitro destroy skin thus take containers, After unde (and contain	rogen is ni ogen makes n or eyes. I appropriat depending erstanding ner) is show	trogen in a liquid state at an extremely low tem s handling it very dangerous because it can caus Professionals who use it must undergo training to e precautions. Liquid nitrogen is stored, shipp upon the quantity required by the user. the feature of liquid nitrogen and associated hazar vn.	perature (< 7 e very seriou properly learn ed and hand ds, the safe ha	7K). The ex s burns tha n about its r lled in seve andling of lie	treme cold of t irreparably eactivity and eral types of quid nitrogen
Objectives					
1. Understa 2. Safe hand 3. Transferr	inding feat dling of liqu ring liquid	ure of liquid nitrogen and associated hazards uid nitrogen and equipment nitrogen from primary container			
[Requireme	nts]				
Basic under	rstanding o	f chemistry and physics			
[Evaluation	ı]				
brief exami practice ski	nation & h 11 : 50%	omework: 50%			
[Textbooks]					
[References]				
[Schedule]					
 01. User guidance of "Center for Instrumental Analysis" 02. Outline and purpose 03. Characteristics of liquid nitrogen and associated hazards 04. Handling liquid nitrogen and containers 05. Transferring liquid nitrogen from primary container (Lecture) 06. Transferring liquid nitrogen from primary container (Training) 07. Summary 					
*1 You shou **2 If you h	07. Summary *1 You should get 1 credit for this class to use liquid nitrogen. **2 If you have already gotten 1 credit for this class in undergraduate, you do not take this class.				

Advanced Instrumental Analysis II A Keisuke Arimoto Satoki Shinozuka [Code] [Credits] [Program] [Semester] [Hours] [Language of instruction] GTI508 1 For All Programs of "Division of Engineering" Intensive ✓ Japanese [Outline and purpose] To learn how to use X-ray diffractometers and analyze X-ray patterns. ✓ Japanese [Objectives] To understand the fundamentals of X-ray diffractometer. ✓ Intensive ✓ Japanese [Requirements] To student should have a third-year level of physics and chemistry at the undergraduate level. ✓ Intensive Japanese [Objectives] To understand the fundamentals of X-ray diffractometers. To understand the fundamentals of X-ray diffractometer. Intensive ✓ Intens	[Title]				[Instructor]	
Induct function f		Adva	nced Instrumental Analysis, II A	K	eisuke Arim	oto
ICodel ICredits IProgram ISemester IHours Inaguage of instruction GT1508 1 For All Programs of "Division of Engineering" Intensive // Japanese IOutline and purposel Intensive // Japanese Japanese IOutline and purposel Intensive // Japanese IObjectives Intensive Intensive // Intensive Intensive Intensive Japanese IObjectives Intensive Intensive Japanese IObjectives Intensive Intensive Intensive Intensive Intensive Intensive Intensive Intensive IRequirements Intestudent should have a third/year level of physics a		11474		Satoki Shinozuka		
GTI508 1 For All Programs of "Division of Engineering" Intensive ✓ Japanese IOutline and purpose To learn how to use X-ray diffractometers and analyze X-ray patterns. Image: Comparison of the second of the seco	[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]
[Outline and purpose] To learn how to use X-ray diffractometers and analyze X-ray patterns. [Objectives] To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [References]	GTI508	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese
To learn how to use X-ray diffractometers and analyze X-ray patterns. IObjectives] To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [References]	[Outline an	d purpose]				
[Objectives] To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [References]	To learn h	ow to use X	X-ray diffractometers and analyze X-ray patterns.			
IObjectives] To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. IRequirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [References]						
IObjectives] To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]						
To understand the fundamentals of X-ray diffraction measurement methods. To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References]	[Objectives]]				
To acquire the ability to operate the X-ray diffractometer. [Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [References]	To understa	and the fun	damentals of X-ray diffraction measurement metho	ods.		
[Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	To acquire	the ability	to operate the X-ray diffractometer.			
[Requirements] 1. The student should have a third-year level of physics and chemistry at the undergraduate level. 2. The student must have completed some student laboratory courses and earned credits in the science department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]						
 The student should have a third-year level of physics and chemistry at the undergraduate level. The student must have completed some student laboratory courses and earned credits in the science department of a university. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] 	[Requireme	ents]				
 The student must have completed some student laboratory courses and earned credits in the science department of a university. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule] 	1. The stu	ident shoul	d have a third-year level of physics and chemistry a	at the undergr	aduate leve	l.
department of a university. 3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	2. The stu	udent mus	t have completed some student laboratory cours	ses and earne	ed credits in	n the science
3. The student's thesis advisor must agree to the use of the X-ray diffractometer at the Instrumental Analysis Center. [Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	departr	nent of a u	niversity.			
[Evaluation] The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	3. The stu Center.	ıdent's thes	is advisor must agree to the use of the X-ray diffra	actometer at t	he Instrume	ental Analysis
The student's basic knowledge of X-ray diffractometry will be evaluated by a quiz (including oral examination) and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	[Evaluation	1]				
and a report. (50%) The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	The studen	t's basic kr	nowledge of X-ray diffractometry will be evaluated	by a quiz (ind	eluding oral	examination)
The students will be evaluated on their ability to operate the X-ray diffraction apparatus and to obtain correct data safely. (50%) [Textbooks] [References] [Schedule]	and a repor	rt. (50%)				
data safely. (50%) [Textbooks] [References] [Schedule]	The studen	ts will be e	evaluated on their ability to operate the X-ray diffe	action appara	atus and to o	obtain correct
[Textbooks] [References] [Schedule]	data safely.	(50%)				
[References] [Schedule]	[Textbooks]					
[References] [Schedule]						
[Schedule]	[References]					
[Schedule]						
[Schedule]						
	[Schedule]					

- 1. Purpose of measurement
- 2. Principle of measurement
- 3. Instrument principle
- 4. Inspection and maintenance of equipment
- 5. Measurement method 1 (sample preparation and operation 1)
- 6. Measurement method 2 (sample preparation and operation 2)
- 7. Measurement method 3 (sample preparation and operation 3)
- 8. Data Analysis Method 1 (Basic)
- 9. Data Analysis Method 2 (Advanced)
- 10. Summary

Note: Students who wish to use the Center's equipment must take courses related to the equipment they wish to use and obtain credits in advance.

		[Title]		[Instructor]		
	Adva	anced Instrumental Analysis IIC	Te Ma	tsuo Kuwab sayo Katsun	ara nata	
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]	
GTI510	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese	
[Outline an	d purpose]					
Nuclear i organic con feature and	magnetic re npounds. It practical a	esonance spectrometry (NMR) is a typical analytic t determines the physical and chemical properties analytical technique of NMR are lectured and traine	eal technique of atom or n ed in this lectu	for structura nolecules. 7 ure.	al analysis of The principle,	
[Objectives]						
 Understa Training Understa Training 	inding prin analytical inding prin analytical	ciple and feature of NMR technique of NMR ciple and feature of NMR technique of NMR				
Requireme	entsl					
Basic know	ledge of org	ranic compounds and NMR spectroscopy				
		,				
[Evaluation	l]					
Participation Practice ski	in class 50% ill:50%					
[Textbooks]						
None						
[References]					
None	-					
[Schedule]						
1. Principle	of NMR					
2. Instrume	entation of 2	NMR				
3. Analytica	3. Analytical procedure of NMR					
4. Sample p	4. Sample preparation, operation and data analysis of NMR 5. Bringinla of NMR					
6. Instrume	6. Instrumentation of NMR					
7. Analytica	7. Analytical procedure of NMR					
8. Sample p	3. Sample preparation, operation and data analysis of NMR					
9. Applicati	ons					
10. Summa	ту					

		[Title]		[Instructor]			
	Adva	nced Instrumental Analysis IIIA	I Ma	Makoto Obat sayo Katsun	a nata		
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]		
GTI511	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese		
[Outline an	d purpose]				1		
The purpos (carbon, hy	e of this co drogen, and	urse is to learn the principles and practical method d nitrogen). Students must take at least one analy	ds of LC-MS a tical techniqu	and/or eleme le from each	ental analysis lecture.		
[Objectives]							
To learn an	d understa	nd data analysis methods used in LC-MS and/or ele	emental analy	sis.			
[Requireme	entsl						
Good under Basic under courses, res	rstanding of prstandings spectively.	f basic organic chemistry is required in all courses of liquid and gas chromatography are beneficial	in LC-MS a	nd/or eleme	ntal analysis		
[Basis of Ex	valuation						
Reports (30	(wilderfold)						
Practical E	xam (70%)						
[Textbooks]							
Title: 役に	立つ有機微量	量元素分析					
Author: (社)日本分析学	会 有機微量分析研究懇談会					
Publisher:	みみずく舎						
ISBN: 978-	4-87211-90	5-3					
References	3]						
Not specifie	ed						
[Schedule]							
1. Guidan	ce						
2. Princip	les of meas	urement					
3. Princip	les of instru	umentation					
4. Mainte	4. Maintenance and inspection of equipment						
5. Instrumental measurement 1 6. Instrumental measurement 2							
7. Instrum	 Instrumental measurement 2 Instrumental measurement 3 						
8. Data ar	8. Data analysis 1						
9. Data analysis 2							
10. Review							
*1 You shou **2 If you h ***3 If you	uld take at i have alread are going t	least one analytical technique course from each lect y gotten 1 credit for this class in undergraduate, yo o use LC-MS or elemental analysis, you should tak	cure to get 1 cr u do not take all correspo	redit for this this class. onding course	class. es to get user		

license.

		[Title]		[Instructor]		
	Adva	nced Instrumental Analysis IIIB	Ma	Ikuo Ueta Isashi Hisan	noto	
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]	
GTI512	1	For All Programs of "Division of Engineering"	Intensive	/	English/ Japanese	
[Outline an	d purpose]					
Theory and	application	n of GC-MS for analyzing organic compounds.				
Ohjectives	1					
1. Understa	nding prin	ciple of GC-MS.				
2. Masterin	g qualitati	ve analysis by GC-MS.				
[Requireme	ents]					
Understand	ling princip	ble of gas chromatography				
[Evaluation	1]					
Practical S	kills Exami	nation: 100%				
[Textbooks]						
[References	s]					
[Schedule]						
1. Object of	GC-MS me	easurement.				
2. Principle	of GC-MS	measurement.				
3. Instrume	ental princi	ple of GC-MS.				
4 Maintena	nce and ins	spection of GC-MS.				
5. Practice 6 Practice	(sample pre	eparation).				
7. Practice2	concasurer concessurer	nent method).				
8. Data ana	8. Data analysis (basic).					
9. Data analysis (application).						
10. Summa	ry.					
*1 You shou	ıld get 1 cre	edit for this class to use GC-MS.				

		[Title]		[Instructor]			
			Т	Takahiro Takei			
Advanced Instrumental Analysis IIIC			Hideto Sakane				
	nuva		Ma	sayo Katsur	nata		
			Ryun	osuke Kawa	amura		
[Code]	[Credits]	[Program]	[Semester] [Hours] [Language instruction				
GTI513	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese		
[Outline an	d purpose]						
The course	e will cover	the principles, structure, and applications of induc	ctively coupled	d plasma op	tical emission		
spectromet	ry (ICP-OF	ES) and X-ray fluorescence spectrometry (XRF),	which are ar	nalytical ins	struments for		
inorganic c	omponents,	as well as practical training in sample preparation	and analytic	al operation	s.		
[Objectives]]						
To understa	and the prin	nciple and structure of ICP-OES and XRF.					
To be able t	o select app	propriate analytical equipment according to sample	e, target comp	onent, conce	entration, etc.		
To be able	to select a	nd implement appropriate pretreatment and conce	entration meth	nod, accordi	ng to sample,		
target comp	oonent, and	concentration.					
To master t	he operatio	on of analyzers.					
[Requireme	ents]						
1. Knowle	dge of basi	c chemistry and reagents.					
2. Knowle	dge of the s	sample to be measured (composition, physical prope	erties, etc.)				
3. Experie	ence in basi	c chemistry experiments such as solution preparati	ion and dilutio	on.			
[Evaluation	1]						
Submit a re	eport on the	e results of the practical training. Determine if the	operation is at	t a feasible l	evel. (80%)		
The evalua	tion will be	based on the student's attitude in lectures and pra	ctical training	g. (20%)			
[Textbooks]	[Textbooks]						
[References	5]						
[Schedule]							

1. Structure and principle of Inductively Coupled Plasma Optical Emission Spectrometry (ICP-OES)

The structure and principles of ICP-OES will be explained, including an overview of atomic spectrum analysis methods.

2. Principles and structure of X-ray fluorescence spectrometer (XRF)

The structure and principles of the X-ray fluorescence spectrometer (XRF) will be explained, including an overview of other X-ray analysis methods.

3. Preparation of standard solutions

The preparation of standard solutions necessary for calibration curves will be explained.

4. Solution preparation methods such as acid digestion

Perchloric acid decomposition, hydrofluoric acid decomposition, microwave decomposition, etc., which are widely used as methods to prepare solutions of solid samples, mainly required for ICP-OES measurements, will be explained.

5. Solid sample preparation

The glass bead method and high-pressure pressing method for solidifying powder samples will be explained as sample preparation methods for XRF analysis.

6. Sample preparation

Students will prepare samples to be used in their research by themselves and prepare standard solutions necessary for measurement. (Hands-on practice)

7. Measurement

Using the samples prepared in step 6, students will actually perform measurements.

8. Summary

Summarize the results of 6 and 7 in a report and submit it.

	[Title]	[Instructor]								
	Adva	nced Instrumental Analysis IIID	Makoto Obata Masayo Katsumata Satoki Shinozuka Ryunosuke Kawamura							
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]					
GTI514	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese					
[Outline and purpose] The purpose of this course is to learn the principles and practical methods of Fourier Transform Infrared Spectroscopy.										
[Objectives]										
 To understand the principle Infrared spectrometry Be familiar with aspect of FTIR operation 										
[Requireme	nts]									
A grounding in infrared spectrometry										
[Evaluation]										
Participation in lecture class (30%) Practice skill (70%)										
[Textbooks]										
[References]										
G. D. Christian, Analytical Chemistry (6th Ed) II Instrumental Analysis (Japanese TR), Maruzen										
[Schedule]										
 Object of Princip Princip Princip Check a Method Method Basic d Advanc Summa 	of IR measure le of IR measure of measure of measure of measure ata analysi ed data ana ry	arement asurement nstrument nance of FTIR instrument ement 1 (sample preparation and practice) ement 2 (sample preparation and practice) ement 3 (sample preparation and practice) s alysis								

	[Title]	[Instructor]							
	Adva	nced Instrumental Analysis IIIE	Tetsuya Sato Keisuke Arimoto Masayo Katsumata						
[Code]	[Credits]	[Program]	[Semester]	[Hours]	[Language of instruction]				
GTI515	1	For All Programs of "Division of Engineering"	Intensive	/	Japanese				
$\label{eq:constraint} \begin{array}{c} \end{purpose} \\ \hline \$									
[Objectives] 1. Understanding principle and feature of LRSS 2. Mastering measurement technique of LRSS 3. Mastering measurement technique of LRSS qualitative analysis 4. Mastering measurement technique of LRSS quantitative analysis									
[Requirements] Understanding the fundamental of Raman effect, laser, light scattering.									
[Evaluation]									
brief examination & homework: 50% practice skill : 50%									
[Textbooks]									
[References]								
[Schedule]									
 Purpose of measurement Principle of LRSS measurement Principle of LRSS analyzer Maintenance of LRSS Operation of LRSS equipment (sample preparation,) Operation of LRSS qualitative analysis Operation of LRSS quantitative analysis Data analysis I (basic) Data analysis II (application) Summary 									
*1 You should get 1 credit for this class to use LRSS.									

**2 If you have already gotten 1 credit for this class in undergraduate, you do not take this class.