Lecutures in iELST, 2024-2025　　*Quarter and Day Period are subject to be change from April, 2025.

Course No.	Course Title Sub-title of the Course	Lecturer	Affiliation	Quarter	Day Period	Credit
L1	Water resources management in a watershed Impact of human activities to hydrology and water quality	Hiroaki Somura	Agricultural Engineering	1Q, 2Q	Tue 1-2	2
L2	Study of Cosmic Microwave Background Polarization Measurement	Hirokazu Ishino	Phys	1Q-4Q	Mon 5-6 (Q1,2) Mon 7-8 (Q3,4)	1
L3	Plant Stress Physiology	MA Jian Feng	Plant Stress Science	1Q, 2Q	Wed 1-4	2
L4	Physiology of Environmental Responses	Maki Katsuhara Takayuki Sasaki	Plant Stress Science	1Q, 2Q	Tue 5-8	2
L5	Solid-state physics and chemistry Electronic properties of graphene: from basic theory to application for FET	Hidenori Goto	RIIS(Chem)	1Q	Mon 1-2	1
L6	Organometallic Catalysis	Yasushi Nishihara	RIIS(Chem)	1Q, 2Q	Mon 3-4	2
L7	Physical Coordination Chemistry Fundamental Aspect and Recent Advancement in Coordination Chemistry	Takayoshi Suzuki	RIIS(Chem)	1Q, 2Q	Wed 1-2	2
L8	Plant-Virus/Bacteria Interactions	Hideki Kondo, Akio Tani Shoko Ueki, Kuwamu Hyodo	Plant Stress Science	1Q, 2Q	Thurs 5-8	2
L9	Advanced Analytical Chemistry	Takashi Kaneta	Chem	1Q, 2Q	Mon 1-2	2
L10	Advanced Synthetic Chemistry Modern Organic Synthesis	Isao Kadota	Chem	1Q, 2Q	Fri 1-2	2
L11	Laboratory manuals for plant bioresources research	Kiyotaka Nagaki	Plant Stress Science	1Q, 2Q	Tue 5-8	2
L12	Reaction Mechanisms for Inorganic Compounds Fundamentals of Colloid and Surface Chemistry in Inorganic Synthesis	Takahiro Ohkubo	Chem	3Q	Tue 1-2	1
L13	Ferroelectric and related phenomena Design of new and high-performance catalysts using ferroelectrics	Jun Kano	Applied Chem	2Q	Wed 3-4	1
L14	Energy Materials Phenomenology and energy applications of oxides and dielectrics	Takashi Teranishi	Applied Chem	1Q	Wed 1-2	1
L15	Device Physics Overviews of fundamentals in advanced electronic/photonic/acoustic devices	Kenji Tsuruta	Elect & Elect Eng	1Q or 2Q	Mon 7-8	1
L16	Modern Information Retrieval	Manabu Ohta	Computer Science	1Q, 2Q	Fri 3-4	2
L19	Media Information Processing Statistical machine learning approaches: neural networks and Bayesian modeling	Koichi Takeuchi	Computer Science	3Q, 4Q	Thur 1-2	2
L20	Ecological Genetics Conservation genetics	Makiko Mimura	Biological Sciences	1Q	Tue 1-2	1
L21	Mechanisms of Plant Development Polyamines as pillars of cellular processes	Taku Takahashi	Biological Sciences	3Q, 4Q	Thur 1-2	1

*TBA = to be announced

Tutorial Studies in iELST, 2024-2025 ***Quarter and Day Period are subject to be change from April, 2025.**

Course No.	Title of Tutorial Studies: Tutorial Studies in ...	Lecturer	Affiliation	Day Period	Credit
T1	Water resources management	Hiroaki Somura	Agricultural Engineering	*DAC	1
T4	Mesoscopic physics	Hidenori Goto	RIIS(Chem)	*DAC	0.5
T5	Organometallic Chemistry	Yasushi Nishihara	RIIS(Chem)	Mon Anytime	2
T6	Physical Coordination Chemistry	Takayoshi Suzuki	RIIS(Chem)	*DAC	1
T7	Molecular Data Science	Masakazu Matsumoto	RIIS(Chem)	Wed 5-6 *On demand	1
T8	Advanced Organic Chemistry	Isao Kadota	Chem	*DAC	1
T9	Advanced Ferroelectric Science	Jun Kano	Applied Chem	*DAC	1
T10	Advanced Device Physics	Kenji Tsuruta	Elect & Elect Eng	*DAC	1
T11	Molecular Genetics/ Molecular Biology	Tatsuhiko Abo	Biological Sciences	*DAC	0.5
T12	Behavioral Genetics	Hideki Nakagoshi	Biological Sciences	*DAC	0.5
T13	Plant Developmental Biology	Taku Takahashi	Biological Sciences	*DAC	0.5

*DAC = decide after consultation with the students
*TBA = to be announced

Lecture Schedule in iELST 2024-2025

Quarter 1

Period / Day	Mon	Tue	Wed		Thur	Fri
Period 1	L5	L1	L3 *2	L7		L10
8:40-9:30	L9	L20	L14			
Period 2	L5	L1	L3 *2	L7		L10
9:40-10:30	L9	L20	L14			
Period 3	L6		L3 *2			L16
10:45-11:35						
Period 4	L6		L3 *2			L16
11:45-12:35						
Period 5	L2	L4 *3			L8 *5	
13:25-14:15		L11 *4				
Period 6	L2	L4 *3			L8 *5	
14:25-15:15		L11 *4				
Period 7	L15 *1	L4 *3			L8 *5	
15:30-16:20		L11 *4				
Period 8	L15 *1	L4 *3			L8 *5	
16:30-17:20		L11 *4				

Quarter 2

Period / Day	Mon	Tue	Wed	Thur	Fri
Period 1	L9	L1	L3 *2		L10
8:40-9:30			L7		
Period 2	L9	L1	L3 *2		L10
9:40-10:30			L7		
Period 3	L6		L3 *2		L16
10:45-11:35			L13		
Period 4	L6		L3 *2		L16
11:45-12:35			L13		
Period 5	L2	L4 *3		L8 *5	
13:25-14:15		L11 *4			
Period 6	L2	L4 *3		L8 *5	
14:25-15:15		L11 *4			
Period 7	L15 *1	L4 *3		L8 *5	
15:30-16:20		L11 *4			
Period 8	L15 *1	L4 *3		L8 *5	
16:30-17:20		L11 *4			

*1 ---This lecture will be scheduled either Quarter 1 or Quarter 2.

*2 --- 1 lecture every 2 weeks: Apr 16, Apr 30, May 14, May 28, Jun 18, Jul 2, Jul 16

*3---1 lecture every 2 weeks: Apr 15, May 7, May 20, Jun 10, Jun 24, Jul 8, Jul 22

*4 --- 1 lecture every 2 weeks: Apr 22, May 13, May 27, Jun 17, Jul 1, Jul 15, Jul 29

*5---1 lecture every 2 weeks: : Apr 17, May 1, May 15, Jun 12, Jun 26, Jul 10, Jul 24

Quarter 3

Period / Day	Mon	Tue	Wed	Thur	Fri
Period 1		L12		L19	
8:40-9:30				L21	
Period 2		L12		L19	
9:40-10:30				L21	
Period 3					
10:45-11:35					
Period 4					
11:45-12:35					
Period 5					
13:25-14:15					
Period 6					
14:25-15:15					
Period 7	L2				
15:30-16:20					
Period 8	L2				
16:30-17:20					

Quarter 4

Period / Day	Mon	Tue	Wed	Thur	Fri
Period 1				L19	
8:40-9:30				L21	
Period 2				L19	
9:40-10:30				L21	
Period 3					
10:45-11:35					
Period 4					
11:45-12:35					
Period 5					
13:25-14:15					
Period 6					
14:25-15:15					
Period 7	L2				
15:30-16:20					
Period 8	L2				
16:30-17:20					

iELST Syllabus (lectures)

No.	**L1**
Lecture title	Water resources management in a watershed
Sub-title of the lecture	Impact of human activities to hydrology and water quality
Lecturer	Hiroaki SOMURA
Contact E-mail	somura@okayama-u.ac.jp
Affiliation	Rural and Environmental Sciences, Graduate School of Environmental, Life, Natural Science and Technology
position	Associate Professor
Specialty	Agricultural Engineering
Quarter	Quarter 1& 2
Day	Tuesday
Period	Period 1 & 2
Hours/Credits	2 credits
Lecture plan	I. Introduction to Water Resources Management: 8 Hours The lecture begins with an introduction to the fundamental concepts and recent studies in water resources management. An overview of the course content will also be provided.
	II. Human Activities and Water Resources (Quantity and Quality): 11 Hours This lecture explores the relationship between human activities and water resource issues, focusing on historical evidence, and includes discussions on their impacts on both water quantity and quality.
	III. Modeling Approaches in Water Resources Management: 11 Hours This lecture examines the latest studies in water resources management, with a particular focus on modeling approaches, supported by relevant literature.

iELST Syllabus (lectures)

No.	**L2**	
Lecture title	Study of Cosmic Microwave Background Polarization Measurement	
Sub-title of the lecture		
Lecturer	Hirokazu ISHINO	
Contact E-mail	scishino@s.okayama-u.ac.jp	
Affiliation	Physics, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty		
Quarter	Quarter 1, 2, 3, 4	
Day	Monday	
Period	Period 5 & 6 (Q1, 2) / Period 7 & 8 (Q3, 4)	
Hours/Credits	1 credit	
Lecture plan	Introduction to General Relativity In this lecture we first introduce general relativity theory. Students will learn the basics of the derivation of Einstein's equation which associates space-time curvature with matter and radiation energy and momentum. We use the variational principle approach to derive the equation. Assuming a homogeneous isotropic universe of Einstein's equation, we derive the Friedmann equation to determine how the space expands.	••• 4 Hours
	Theoretical basis of Cosmology Following the previous chapter, students will learn the theoretical framework of the expansion of the universe based on Friedmann equations. The space expansion in the universe is governed by the contents contained in it. We discuss the thermal history of the universe, Big Bang nucleosynthesis and the production of the Cosmic Microwave Background (CMB) Radiation. Students will learn how the age of the universe is obtained based on the measurement values with the Lambda-CDM model which is one of the standard models of the universe.	••• 6 Hours
	Experimental techniques of the CMB measurements Finally students will learn the experimental techniques for the detection of the micro-wave radiation from the sky. We will introduce the basics of the radio astronomy experimental techniques. Students will learn the concept of the noise equivalent power with Fourier transformation and noise equivalent temperature which is used to identify the sensitivity of the experiments. We will introduce the experiments and future plans including a satellite project LiteBIRD to detect the CMB B mode polarization.	••• 4 Hours
	Group discussion and presentation for CMB physics Student groups will be formed to conduct group discussions on topics related to the CMB physics the group selects. Each group will give an oral presentations for 20 minutes and will discuss with other groups to deepen their understanding.	••• 2 Hours

iELST Syllabus (lectures)

No.	**L3**	
Lecture title	Plant Stress Physiology	
Sub-title of the lecture		
Lecturer	MA Jian Feng	
Contact E-mail	maj@rib.okayama-u.ac.jp	
Affiliation	Plant Stress Science, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Plant Stress Responses	
Quarter	Quarter 1& 2	
Day	Wednesday *not every week	
Period	Period 1 - 4	
Hours/Credits	2 credits	
Lecture plan	1. Abiotic stress and mineral stress (Ma) 2. Response and tolerance mechanisms of plants to deficiency stresses of essential elements (Ma) 3. Response and tolerance mechanisms of plants to excess stresses of toxic elements (Yamaji) 4. Role of node in mineral element distribution (Yamaji) 5. Transport mechanism of micronutrients（Mitani) 6. Transport mechanism of beneficial elements (Mitani)	30 Hours

iELST Syllabus (lectures)

No.	**L4**	
Lecture title	Physiology of Environmental Responses	
Sub-title of the lecture		
Lecturer	Professor KATSUHARA Maki, Associate Professor SASAKI Takayuki	
Contact E-mail	kmaki@okayama-u.ac.jp	
Affiliation	Plant Stress Science, Graduate School of Environmental, Life, Natural Science and Technology	
position		
Specialty	Plant Molecular Physiology	
Quarter	Quarter 1& 2	
Day	Tuesday *not every week	
Period	Period 5 - 8	
Hours/Credits	2 credits	
Lecture plan	Tuesday afternoon every 2 weeks from April to July with 7 classes. After the first class of introductions by Dr. Katsuhara and Dr. Sasaki, Dr. Katsuhara will make his lectures in the 2nd - 4th classes, and Dr. Sasaki in the 5th - 7th classes. Following each two subjects will be subjected in one class. (1) Basic physiology of cells, tissues, and organs responding to environmental stresses (introduction). (2) Membranes and transporters in plants (introduction). (3) Water stress as global environments. (4) Water transport (Theory and molecular mechanisms). (5) Recent progress in water transport and multi-function of aquaporins. (6) Salt stress and ion transport (Theory and molecular mechanisms). (7) Recent progress in ion transporters and stress tolerance. (8) Signal transduction in the response to stress environment (9) Acid-soil stress and aluminum ions (10) Oxidative stress and program cell death under environmental stress conditions (11) Sugar transporter regulate plant growth (12) Anion transporters associated with environmental conditions (Acid-soil stress) (13) Anion transporters associated with environmental conditions (The other stresses) (14) Plant physiology of environmental stress response (Discussion)	30 Hours

iELST Syllabus (lectures)

No.	**L5**	
Lecture title	Solid-state physics and chemistry	
Sub-title of the lecture	Electronic properties of graphene: from basic theory to application for FET	
Lecturer	Hidenori Goto	
Contact E-mail	hgoto@okayama-u.ac.jp	
Affiliation	Research Institute for Interdisciplinary Science	
position	associate professor	
Specialty	Mesoscopic physics	
Quarter	Quarter 1	
Day	Monday	
Period	Period 1 & 2	
Hours/Credits	1 credit	
Lecture plan	The aim of this lecture is to learn how to understand electronic states and quantum phenomena in solids based on a simple but profound two-dimensional material, graphene.	
	I. Band theory in solids The lecture starts by introducing basic band theories to describe electronic states in crystals.	••• 4 Hours
	II. Crystal and band structures of graphene The band structure of graphene is deduced on a tight-binding model. The linear dispersion relation between energy and momentum with a topological singularity is discussed.	••• 4 Hours
	III. Transport and magnetic properties of graphene The peculiar transport properties resulting from the topological singularity, such as the absence of back-scattering and the half-integer quantum Hall effect, are discussed.	••• 4 Hours
	IV. Application for graphene FETs Practical application of graphene for field-effect transistors (FETs) is mentioned. The characteristics of graphene FETs are compared with those of conventional inorganic FETs.	••• 3 Hours

iELST Syllabus (lectures)

No.	**L6**	
Lecture title	Organometallic Catalysis	
Sub-title of the lecture	Organometallic Catalysis	
Lecturer	Yasushi NISHIHARA	
Contact E-mail	ynishiha@okayama-u.ac.jp	
Affiliation	Research Institute for Interdisciplinary Science	
position	Professor	
Specialty	Synthetic Organic Chemistry	
Quarter	Quarter 1 & 2	
Day	Monday	
Period	Period 3 & 4	
Hours/Credits	2 credits	
Lecture plan	I. Organometallic Chemistry and Catalytic Reactions The lecture starts by introducing some typical examples and recent topics in organometallic chemistry and catalytic reactions. An overview of this course will be provided.	••• 5 Hours
	II. Organometallic Chemistry and Reaction Mechanism This chapter provides the reaction mechanism of organometallic chemistry. Fundamental reactions in the catalytic cycles are discussed.	••• 5 Hours
	III. Hydroformylation and Related Reactions This chapter provides the hydroformylation and its related reactions. Four types of catalytic hydroformylation are discussed.	••• 4 Hours
	IV. Acetic Acid and Acetyl Compounds This chapter provides the synthetic routes of acetic acid and acetyl compounds. In particular, the Wacker oxidation, Monsanto process and their reaction mechanisms are discussed.	••• 6 Hours
	V. Nylon Intermediate This chapter provides the synthetic routes of Intermediates related to Nylon. In particular, the Hydrocyanation of 1,4-butadiene and its reaction mechanism are discussed.	••• 4 Hours
	VI. Oligomerization and Polymerization of Olefins This chapter provides transition-metal-catalyzed oligomerization and polymerization of olefins. In particular, SHOP (Shell Higher Order Process) and its reaction mechanism are discussed.	••• 6 Hours

iELST Syllabus (lectures)

No.	**L7**	
Lecture title	Physical Coordination Chemistry	
Sub-title of the lecture	Fundamental Aspect and Recent Advancement in Coordination Chemistry	
Lecturer	Takayoshi SUZUKI	
Contact E-mail	suzuki@okayama-u.ac.jp	
Affiliation	Research Institute for Interdisciplinary Science	
position	Professor	
Specialty	Coordination Chemistry	
Quarter	Quarter 1 & 2	
Day	Wednesday	
Period	Period 1 & 2	
Hours/Credits	2 credits	
Lecture plan	I. Introduction: Overview of this course The lecture starts by introducing some typical examples and recent topics in coordination chemistry. An overview of this course will be provided.	••• 2 Hours
	II. Structural Coordination Chemistry This chapter provides the diversity and specificity of coordination compounds. Stereochemistry and isomerism of coordination compounds, syntheses and functionality of metal-organic frameworks and cluster compounds are discussed.	••• 6 Hours
	III. The Angular Overlap Model This chapter provides one of the basic and important theoretical approach, AOM, for understanding the structures and properties of coordination compounds.	••• 4 Hours
	IV. Spectroscopic, Magnetic and Electrochemical Properties This chapter provides the fundamental idea and basic theory to understand the characteristic properties of coordination compounds, e.g. ligand-field spectra, spin-cross over and magnetism, and multi-redox properties.	••• 8 Hours
	V. Photochemistry and Photophysics This chapter provides some recent examples and fundamental knowledge for photochemistry and photophysics of coordination compounds. The photo-functionality is one of the current topics in coordination chemistry.	••• 4 Hours
	VI. Bioinorganic Chemistry This chapter provides advanced idea how the coordination compounds act as catalysts for small molecule activation in organism. The reaction mechanism using an active metal centre is fascinating.	••• 6 Hours

iELST Syllabus (lectures)

No.	**L8**	
Lecture title	Plant-Virus/Bacteria Interactions	
Sub-title of the lecture		
Lecturer	KONDO Hideki, TANI Akio, UEKI Shoko, HYODO Kiwamu	
Contact E-m	hkondo@okayama-u.ac.jp; atani@rib.okayama-u.ac.jp; shokoueki@okayama-u.ac.jp; khyodo@okayama-u.ac.jp	
Affiliation	Plant Stress Science, Graduate School of Environmental, Life, Natural Science and Technology; Institute of Plant Science and Resources	
position	Associate Professor	
Specialty	Molecular Virology and Bacteriology	
Quarter	Quarter 1& 2	
Day	Thursday (One lecture every two weeks)	
Period	Period 5 - 8	
Hours/Cred	2 credits	
Lecture plan	1: Course guidance, Structure and function of microbial cells、Nutrition and classification of microorganisms (Tani) 2: Important microorganisms for plant-microbe interaction、Analytical methods for microbial community structure (Tani) 3: Recent advances in plant-microbe interaction research 1 (Tani) 4: Recent advances in plant-microbe interaction research 2 (Tani), What are algae? Its taxonomy and evolution 1 (Ueki) 5: What are algae? Its taxonomy and evolution 2 (Ueki) 6: Interaction between algae and bacteria (Ueki) 7: Interaction between algae and virus (Ueki) 8: Introduction to Virology (Kondo) 9: Virus diversity and their evolution (Kondo) 10: Virus transmission and vector interaction (Kondo) 11: Virus diagnosis and control (Kondo), Virus genome structure (Hyodo) 12: Virus gene expression strategy (Hyodo) 13: Virus replication (Hyodo) 14: Virus symptom and host defense (Hyodo)	30 Hours

iELST Syllabus (lectures)

No.	**L9**	
Lecture title	Advanced Analytical Chemistry	
Sub-title of the lecture		
Lecturer	Takashi KANETA	
Contact E-mail	kaneta@okayama-u.ac.jp	
Affiliation	Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Analytical Chemistry	
Quarter	Quarter 1 & 2	
Day	Monday	
Period	Period 1 & 2	
Hours/Credits	2 credits	
Lecture plan	Types and characteristics of lasers: Fundamentals on the principle of laser oscillation, types, and characteristics will be described.	••• 4 Hours
	Safety consideration of lasers: General consideration of the safety in the use of lasers will be described.	••• 4 Hours
	Laser spectroscopy: The principles of several spectroscopies using lasers will be described.	••• 10 Hours
	Application of laser spectroscopy to bioanalysis: Recent applications of laser spectroscopies in the field of analytical chemistry will be introduced.	••• 12 Hours

iELST Syllabus (lectures)

No.	**L10**	
Lecture title	Advanced Synthetic Chemistry	
Sub-title of the lecture	Modern Organic Synthesis	
Lecturer	Isao KADOTA	
Contact E-mail	kadota-i@okayama-u.ac.jp	
Affiliation	Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Organic Chemistry	
Quarter	Quarter 1 & 2	
Day	Friday	
Period	Period 1 & 2	
Hours/Credits	2 credits	
Lecture plan	I. Synthetic Design The lecture starts be intriducing the importance of synthetic design and the concept of retrosynthetic analysis for multi-step synthesis.	••• 4 Hours
	II. Stereochemical Considerations in Planning Syntheses This chapter describes the conformational analysis of cyclic and acyclic molecules, and the importance for the stereoselectivities.	••• 4 Hours
	III. The Concept of Protecting Functional Groups This chapter describes the variety of protective groups, and the methods for the intriduction and removal of the protective groups.	••• 4 Hours
	IV. Oxidation and Reduction This chapter describes the typical conditions and features of oxidation and reduction of organic molecule.	••• 8 Hours
	V. Reactions of Carbon-Carbon Double Bonds This chapter describes the characteristic reactions of carbon-carbon double bonds.	••• 4 Hours
	VI. Reactions of Carbon-Carbon Triple Bonds This chapter describes the characteristic reactions of carbon-carbon tirple bonds.	••• 4 Hours
	VII. Conclusion and Examination The chapter provides a conclusion and some examinations to understand the inpotance of synthetic design for the multi-step synthesis.	••• 4 Hours

iELST Syllabus (lectures)

No.	**L11**	
Lecture title	Laboratory manuals for plant bioresources research	
Sub-title of the lecture		
Lecturer	Kiyotaka NAGAKI	
Contact E-mail	nagaki@rib.okayama-u.ac.jp	
Affiliation	Plant Stress Science, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Integrated Genomic Breeding	
Quarter	Quarter 1& 2	
Day	Tuesday *not every week	
Period	Period 5 - 8	
Hours/Credits	2 credits	
Lecture plan	In order to become a scientist for plant bioresources research, it is necessary to understand and master the following things. 1, Understanding of compliance for scientists 2. Having basic knowledge in this field by reading papers and books 3, Understanding equipment usage in this field and possible analyses using those 4, Logically planning of experiments 5, Obtaining of reproducible experimental data 6, Correct analyze ways for the obtained data 7, Presentation on these data and analyses This lecture is necessary for understanding and acquiring these.	30 Hours
	1. Time management and a scientific regard 2. Search and management of information 3. Skills for writing papers 4. Skills for oral presentations 5. Rules for chemicals and transformants 6. Compliance of scientists 7. What's able to conduct by using common apparatus? (Atomic absorption, ICP-MS) 8. What's able to conduct by using common apparatus? (MALDI-TOF、LC-MS) 9. What's able to conduct by using common apparatus? (Transmission electron microscope) 10. What's able to conduct by using common apparatus? (Scanning electron microscope) 11. What's able to conduct by using common apparatus? (DNA sequencer & qPCR) 12. What's able to conduct by using common apparatus? (Microarray) 13. Meister's technical lectures (membranal protein, microbe classification, immunostaining) 14. Meister's technical lectures (fused protein, transformation of plants, real time imaging) 15. Data-analysis using statistics	

iELST Syllabus (lectures)

No.	**L12**	
Lecture title	Reaction Mechanisms for Inorganic Compounds	
Sub-title of the lecture	Fundamentals of Colloid and Surface Chemistry in Inorganic Synthesis	
Lecturer	Takahiro OHKUBO	
Contact E-mail	ohkubo@okayama-u.ac.jp	
Affiliation	Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Inorganic Chemistry	
Quarter	Quarter 3	
Day	Tuesday	
Period	Period 1 & 2	
Hours/Credits	1 credit	
Lecture plan	I. Introduction: Colloidal state The lecture starts by introducing some fundamental concepts and state-of-the-art topics in colloid and interface chemistry. Especially, the importance of fundamental concepts in colloid and interface chemistry in the synthesis of ordered nanoporous materials will be provided.	••• 2 Hours
	II. Liquid-gas and liquid-liquid interfaces This chapter provides fundamentals of some liquid interfaces. First, some important points of surface tension (or surface free energy) will be discussed. Then some practical examples related to surface tension will be provided. Finally, the concept of surface tension will be applied to liquid-liquid interfaces with a fundamental theorem in thermodynamics.	••• 8 Hours
	III. Solid-gas interface This chapter provides some basic concepts related to adsorption phenomena at solid interfaces.	••• 4 Hours
	IV. Nanoporous materials from soft templates This chapter summarizes the importance of colloid and surface chemistry by demonstrating some important method to synthesize ordered nanoporous materials including mesoporous metal oxides and silica-templated carbons.	••• 2 Hours

iELST Syllabus (lectures)

No.	**L13**	
Lecture title	Ferroelectric and related phenomena	
Sub-title of the lecture	Design of new and high-performance catalysts using ferroelectrics	
Lecturer	Jun KANO	
Contact E-mail	kano-j@cc.okayama-u.ac.jp	
Affiliation	Applied Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Solid-state physics, Catalytic chemistry	
Quarter	Quarter 2	
Day	Wednesday	
Period	Period 3 & 4	
Hours/Credits	1 credit	
Lecture plan	I. Introduction: Overview of this course The lecture starts by introducing essential background and recent topics in ferroelectric materials. An overview of this course will be provided.	••• 2 Hours
	II. Dielectric Property and phonon dynamics This chapter provides the fundamental ferroelectric properties observed dielectric measurement and inelastic scattering such as Raman, Brillouin and terahertz spectroscopies.	••• 7 Hours
	III. Semiconducting property of ferroelectrics We can treat ferroelectric materials as semiconductor with wide band gap. This chapter provides firstly the fundamental knowledge of semiconductor, and then try to understand a characteristic behavior of ferroelectric semiconducting property. Finally, the application will be introduced such as electron tunneling, photo volatile, photocatalysis, and oxidation-reduction catalysis.	••• 7 Hours

iELST Syllabus (lectures)

No.	**L14**	
Lecture title	Energy Materials	
Sub-title of the lecture	Phenomenology and energy applications of oxides and dielectrics	
Lecturer	Takashi TERANISHI	
Contact E-mail	terani-t@cc.okayama-u.ac.jp	
Affiliation	Applied Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Functional Ceramics, Dielectrics, Ferroelectrics	
Quarter	Quarter 1	
Day	Wednesday	
Period	Period 1 & 2	
Hours/Credits	1 credit	
Lecture plan	I. Introduction: Overview of this course The lecture provides introduction of energy applications and functional materials utilized to those energy devices.	••• 2 Hours
	II. Functional electro-ceramics This chapter provides basics of dielectrics, semi-conductor, and ion-conductor ceramics. Polarization mechanism in dielectrics, valence control in semi-conductors, and ion conduction mechanism in oxides are explained.	••• 2 Hours
	III. Phenomenology of dielectric and ferroelectric ceramics The lecture provides basic idea of dielectrics, piezoelectrics and ferroelectrics. The origin of dielectric polarization and role of ferroelectric domains are explained. The lecture also explains dielectric dispersion phenomenon as well as thermodynamics in ferroelectrics linked to Landau theory.	••• 4 Hours
	IV. Applications of electro-ceramics: From capacitors to batteries This chapter introduces the various applications of functional electro-ceramics; from conventional ceramic capacitors and ferroelectric memories to next generation secondary batteries.	••• 4 Hours
	V. Group work/debate related to energy materials	••• 4 Hours

iELST Syllabus (lectures)

No.	**L15**	
Lecture title	Device Physics	
Sub-title of the lecture	Overviews of fundamentals in advanced electronic/photonic/acoustic devices	
Lecturer	Kenji TSURUTA	
Contact E-mail	tsuruta@okayama-u.ac.jp	
Affiliation	Electrical and Electronic Engineering, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Materials Science, Device Physics	
Quarter	Quarter 1 OR 2	
Day	Monday	
Period	Period 7 & 8	
Hours/Credits	1 credit	
Lecture plan	**** Students can choose any two topics from II-V listed below. ****	
	I Introduction: Overview of the course The lecture starts by introducing recent topics in novel electronic/photonic/acoustic devices. An overview of this course will be provided.	••• 2 Hours
	II Semiconductor Devices This chapter deals with essential contents in solid-state and semiconductor physics.	••• 7 Hours
	III Photonic Devices This chapter provides fundamental theories for solar cell, optical fiber, laser, photonic crystal, and plasmonic devices. Methodologies of numerical simulations for those topics will also be covered.	••• 7 Hours
	IV Acoustic Devices Beginning with fundamental theories of elasticity, this chapter provides the essence acoustic /elastic devices including piezoelectric device, surface-acoustic device, and phononic crystal. Methodologies of numerical simulations for those topics will also be covered.	••• 7 Hours
	V Electronic Theories for Nanostructure Devices This chapter provides outline of contemporary methodologies of materials simulations for nanostructured devices, based mainly on the density-functional theory (DFT). Applications of the method include semiconductor nanodevices (quantum wire/dot), metallic nanoparticles.	••• 7 Hours

iELST Syllabus (lectures)

No.	**L16**	
Lecture title	Modern Information Retrieval	
Sub-title of the lecture	None	
Lecturer	Manabu OHTA	
Contact E-mail	ohta@okayama-u.ac.jp	
Affiliation	Computer Science, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Data Engineering	
Quarter	Quarter 1 & 2	
Day	Friday	
Period	Period 3 & 4	
Hours/Credits	2 credits	
Lecture plan	I. Introduction to Information Retrieval (IR) In this lecture, I first explain overview of information retrieval (IR). Students will learn the components of IR systems including indexing methods and queries. They also learn some basic IR models such as Boolean and vector space models. I also introduce some existent IR systems.	••• 8 Hours
	II. Evaluation of IR Following the previous chapter, students will learn evaluation of IR systems, which include important evaluation metrics such as recall and precision for IR. They will also learn prominent IR evaluation frameworks such as the Text REtrieval Conference (TREC) in the US and the NII (National Institute of Informatics) Test Collection for Information Resources (NTCIR) in Japan.	••• 4 Hours
	III. Full-text Search In this chapter, students will learn some famous full-text search techniques such as the signature file and the inverted index.	••• 4 Hours
	IV. Search Engines Search engines are one of the practical IR systems most people use every day. In this chapter, I will introduce the basics of search engines including their crawlers, indexing, and search process. Students will also learn the concept and algorithm of PageRank used by Google search engine to rank Web pages in their search results.	••• 4 Hours
	V. Data Mining and Review Finally students will learn some data mining techniques because data mining is closely related to IR and especially important in this big data era. They will learn association rule mining for discovering interesting rules or patterns in databases by Apriori algorithm and also learn Apriori-based sequential pattern mining.	••• 10 Hours

iELST Syllabus (lectures)

No.	**L19**	
Lecture title	Media Information Processing	
Sub-title of the lecture	Statistical machine learning approaches: neural networks and Bayesian modeling	
Lecturer	Koichi TAKEUCHI	
Contact E-mail	takeuc-k@okayama-u.ac.jp	
Affiliation	Computer Science, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Natural language processing	
Quarter	Quarter 3 & 4	
Day	Thursday	
Period	Period 1 & 2	
Hours/Credits	2 credits	
Lecture plan	I. Introduction: Basic learning models of neural networks The lecture starts by introducing some typical learning approaches for neural networks. Backpropagation, 3-layer neural networks and design of the non-linear functions at the final layer are discussed.	••• 8 Hours
	II. Recent techniques of neural networks This chapter provides recent techniques to make neural networks learn latent information of the target task. Pre-training and auto encoder are discussed.	••• 2 Hours
	III. Well-known network structures This chapter provides efficient neural network structures especially for categrizing sequential inputs such as texts. Convolutional neural networks, recurrent neural networks, LSTM, neural-attention models, transformers are discussed.	••• 12 Hours
	IV. Bayesian modeling This chapter provides Bayesian modeling that is a generative model to assume prior functions focusing on Topic modeling. The basic three types of estimation approaches, maximum likelihood estimation, maximum a posteriori estimation and basian inference are discussed.	••• 8 Hours

iELST Syllabus (lectures)

No.	**L20**	
Lecture title	Ecological Genetics	
Sub-title of the lecture	conservation genetics	
Lecturer	Makiko MIMURA	
Contact E-mail	m.mimura@okayama-u.ac.jp	
Affiliation	Biological Sciences, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Plant Ecology	
Quarter	Quarter 1	
Day	Tuesday	
Period	Period 1 & 2	
Hours/Credits	1 credit	
Lecture plan	I. Introduction to Ecological Genetics The lecture starts by introducing how population genetics have contributed to understand ecological and evolutionary processes in wild populations. You will learn how genetic diversity takes a role in ecology and evolution as well as how we can estimate and evaluate it.	••• 4 Hours
	II. Population History in Changing Environments We will have a book reading club and interactively discuss topics in population dynamics under changing environments. We will learn about changes in the distribution of species over time and space in response to environmental changes, such as climate change.	••• 4 Hours
	III. Natural Selection in Wild Populations We will have a book reading club and interactively discuss topics in natural selection acting in wild populations and how it can be detected. You will also learn some basic statistical tests for natural selection.	••• 4 Hours
	IV. Topics in Ecological Genetics We will self-introduce topics in ecological genetics; evolution of invasive speices, adaptation to environmental changes, consequences of being small populations.	••• 2 Hours

iELST Syllabus (lectures)

No.	**L21**	
Lecture title	Mechanisms of Plant Development	
Sub-title of the lecture	Polyamines as pillars of cellular processes	
Lecturer	Taku TAKAHASHI	
Contact E-mail	perfect@okayama-u.ac.jp	
Affiliation	Biological Sciences, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Plant developmental biology	
Quarter	Quarter 3, 4	
Day	Thursday	
Period	Period 1 & 2	
Hours/Credits	1 credit	
Lecture plan	I. Introduction: Overview of this course Introduction of biogenic polyamines/ An overview is given, including a brief history of polyamine biology.	••• 3 Hours
	II. Distribution and diversity of polyamines in living organisms Distribution, structural diversity, and biosynthetic pathways of polyamines in bacteria, plants and animals.	••• 3 Hours
	III. Physiological function of polyamines Important roles of polyamines in various aspects of cellular processes are comprehensively reviewed.	••• 3 Hours
	IV. The mode of action of polyamines in mRNA translation Specific regulatory roles of polyamines in mRNA translation are presented.	••• 3 Hours
	V. State-of-the-art research on plant polyamines New findings on the function of plant polyamines, especially achieved using genetic mutants of a model plant Arabidopsis are shown. The power of molecular genetics in studying polyamine functions will be discussed.	••• 3 Hours

iELST Syllabus (tutorial studies)

No.	**T1**
Tutorial study title	Tutorial studies in water resources management
Main topic of the study	Hydrology and Water Quality
Lecturer	Hiroaki SOMURA
Contact E-mail	somura@okayama-u.ac.jp
Affiliation	Rural and Environmental Sciences, Graduate School of Environmental, Life, Natural Science and Technology
position	Associate Professor
Specialty	Agricultural Engineering
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	1 credit
Lecture plan	1 --- Hydrologic modeling 30 Hours 2 --- Water quality analyses (TN, TP, Ions, heavy metals, SS, TOC etc) *Choose 1 topic and study for 30 hours, or study both topics for 15 hours each.
	Outline 1: Initially, the use of the hydrologic model is explored through independent study by the student, using tutorial documents and datasets, with guidance provided through personal lessons from the professor and tutors. Next, the student selects a target country or watershed and begins collecting and preparing the necessary datasets, with support from the professor and tutors. Then, the student uses the model to reproduce and analyze the hydrology and water quality of the selected country or watershed.
	Outline 2:Initially, the student studies the procedures for analyzing water quality in the target area. Next, using water samples collected by the student, the data is analyzed and summarized. Then, temporal and spatial variations are evaluated with support from the professor and tutors.

iELST Syllabus (tutorial studies)

No.	**T4**
Tutorial study title	Tutorial Studies in Mesoscopic physics
Main topic of the study	Coherent transport properties in mesoscopic systems
Lecturer	Hidenori Goto
Contact E-mail	hgoto@okayama-u.ac.jp
Affiliation	Research Institute for Interdisciplinary Science
position	associate professor
Specialty	Mesoscopic physics
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	0.5 credit
Lecture plan	The aim of this lecture is to study several topics in mesoscopic physics. Through textbooks and recent papers, students learn the universal electronic properties which are described by quantum physics. The examples of topics are listed below. The tutorial lessons include interactive questions, discussion, and presentation about the topics. 1 -- Coherent transport in mesoscopic systems. 2 -- The wave-particle duality of an electron. 3 -- Size effects on ordered states.

iELST Syllabus (tutorial studies)

No.	**T5**
Tutorial study title	Organometallic Chemistry
Main topic of the study	
Lecturer	Yasushi NISHIHARA
Contact E-mail	ynishiha@okayama-u.ac.jp
Affiliation	Research Institute for Interdisciplinary Science
position	Professor
Specialty	Synthetic Organic Chemistry
Quarter	Quarter 1 & 2
Day	Monday
Period	Any time
Hours/Credits	2 credits
Lecture plan	Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by professor and tutors) together with independent self-study (by student) with the aid of a suitable textbook and recent literatures (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with professor (or tutors). A final presentation/examination about the studied subject is mandatory.
	Title: Stereochemistry of Olefins •••15 Hours
	Title: Carbon-Hydrogen Activation •••15 Hours
	Title: Cross-Coupling Reactions •••15 Hours
	Title: Organic Semiconductors •••15 Hours

iELST Syllabus (tutorial studies)

No.	**T6**
Tutorial study title	Tutorial for Physical Coordination Chemistry
Main topic of the study	Coordination Chemistry
Lecturer	Takayoshi SUZUKI
Contact E-mail	suzuki@okayama-u.ac.jp
Affiliation	Research Institute for Interdisciplinary Science
position	Professor
Specialty	Coordination Chemistry
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	1 credit
Lecture plan	Several aspects of the topics listed below are studied by personal tutorial lessons (by professor and tutors) together with independent self-study (by student) with the aid of a suitable textbook and recent literatures (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with professor (or tutors). A final presentation/examination about the studied subject is mandatory.
	1 -- Stereochemistry of Coordination Compounds ••• 6 Hours
	2 -- Ligand Field Theory and Its Application ••• 8 Hours
	3 -- Physical Inorganic Chemistry ••• 8 Hours
	4 -- Bioinorganic Chemistry ••• 8 Hours

iELST Syllabus (tutorial studies)

No.	**T7**
Tutorial study title	Tutorial Studies in Molecular Data Science
Main topic of the study	Practical Programming in Python language
Lecturer	Masakazu Matsumoto
Contact E-mail	matsu-m3@okayama-u.ac.jp
Affiliation	Research Institute for Interdisciplinary Science
position	associate professor
Specialty	Theoretical Chemistry
Quarter	Quarter 1
Day	Wednesday *on demand
Period	Period 5 & 6 (online) *on demand
Hours/Credits	1 credit
Lecture plan	Outline: Python language has been getting more and more popular over these last 10 years. Nowadays, demonstrational implementations of the newest researches in artificial intelligence are often available in and only in Python. Python is favoured due to its simple and clear syntax, easy data treatment, full extensibility, etc. In this course, Python programming is practiced from the beginning to the advanced stage. Bring your own PC.
	Introduction to Python ••• 2 Hours
	Basic features ••• 4 Hours
	Advanced features for scientific calculations ••• 8 Hours
	Machine learning and beyond. ••• 6 Hours

iELST Syllabus (tutorial studies)

No.	**T8**	
Tutorial study title	Tutorial Studies in Advanced Organic Chemistry	
Main topic of the study	Modern Organic Synthesis	
Lecturer	Isao Kadota	
Contact E-mail	kadota-i@okayama-u.ac.jp	
Affiliation	Division of Molecular Sciences, Graduate School of Natural Science and Technology	
position	Professor	
Specialty	Organic Chemistry	
Quarter	(decide after consultation with the students)	
Day	(decide after consultation with the students)	
Period	(decide after consultation with the students)	
Hours/Credits	1 credit	
Lecture plan	Various synthetic methods and reactions in modern organic chemistry will be discussed with some examples.	
	I. Synthetic Design	••• 4 Hours
	II. Stereochemical Considerations in Planning Syntheses	••• 4 Hours
	III. The Concept of Protecting Functional Groups	••• 4 Hours
	IV. Oxidation and Reduction	••• 8 Hours
	V. Reactions of Carbon-Carbon Double Bonds	••• 4 Hours
	VI. Reactions of Carbon-Carbon Triple Bonds	••• 4 Hours
	VII. Conclusion and Examination	••• 4 Hours

iELST Syllabus (tutorial studies)

No.	**T9**	
Tutorial study title	Tutorial Studies in Advanced Ferroelectric Science	
Main topic of the study	Ferroelectrics	
Lecturer	Jun KANO	
Contact E-mail	kano-j@cc.okayama-u.ac.jp	
Affiliation	Applied Chemistry, Graduate School of Environmental, Life, Natural Science and Technology	
position	Associate Professor	
Specialty	Solid state physics, Catalytic chemistry	
Quarter	(decide after consultation with the students)	
Day	(decide after consultation with the students)	
Period	Period 1&2 or 3&4	
Hours/Credits	1 credit	
Lecture plan	Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by professor and tutors) together with independent self-study (by student) with the aid of a suitable textbook and recent literatures (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with professor (or tutors). A final presentation/examination about the studied subject is mandatory.	
	1: Inversion symmetry breaking and structural phase transition of ferroelectrics	••• 7 Hours
	2: Application of ferroelectrics and its future perspective	••• 7 Hours
	3: Ferroelectric semiconductor	••• 8 Hours
	4: Ferroelectric catalyst	••• 8 Hours

iELST Syllabus (tutorial studies)

No.	**T10**
Tutorial study title	Tutorial Studies in Advanced Device Physics
Main topic of the study	Advanced Electronic/Photonic/Plasmonic/Acoustic Device Physics
Lecturer	Kenji TSURUTA
Contact E-mail	tsuruta@okayama-u.ac.jp
Affiliation	Electrical and Electronic Engineering, Graduate School of Environmental, Life, Natural Science and Technology
position	Professor
Specialty	Materials Science, Device Physics
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	1 credit
Lecture plan	1 -- Title: Advanced Electronic Devices 2 -- Title: Advanced Photonic/Plasmonic Devices 3 -- Title: Advanced Acoustic/Elastic Devices 4 -- Title: Advanced Materials Simulation Outline: Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by professor and tutors) together with independent self-study (by student) with the aid of a suitable textbook and recent literatures (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with professor (or tutors). A final presentation/examination about the studied subject is mandatory.

iELST Syllabus (tutorial studies)

No.	**T11**
Tutorial study title	Tutorial Studies in Molecular Genetics/ Molecular Biology
Main topic of the study	Innovative Molecular biology approaches to gene expression
Lecturer	Tatsuhiko ABO
Contact E-mail	tabo@okayama-u.ac.jp
Affiliation	Biological Sciences, Graduate School of Environmental, Life, Natural Science and Technology
position	Professor
Specialty	Molecular Genetics / Molecular Biology
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	0.5 credit
Lecture plan	Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by a professor and tutors) together with independent self-study (by the student) with the aid of suitable papers (suggested by professor). Up-to-date papers will be provided for both of two titles. The 1st title should include genetic point of view such as how the topics were identified or solved. The latter should summarize comprehensive view of the specific topic. The tutorial lessons include interactive questions and discussion about the topics with the professor (or the tutors). A final presentation/examination of the studied subject is mandatory. *Please contact the lecturer in advance before applying for this tutorial studies.
	The power of bacterial genetics revisited ••• 5 Hours
	Ribosome rescue, how the cells maintain their gene expression system in shape? •••10 Hours

iELST Syllabus (tutorial studies)

No.	**T12**
Tutorial study title	Tutorial Studies in Behavioral Genetics
Main topic of the study	Sexual Behavior in *Drosophila*
Lecturer	Hideki NAKAGOSHI
Contact E-mail	goshi@cc.okayama-u.ac.jp
Affiliation	Biological Sciences, Graduate School of Environmental, Life, Natural Science and Technology
position	Professor
Specialty	Molecular Genetics
Quarter	(decide after consultation with the students)
Day	(decide after consultation with the students)
Period	(decide after consultation with the students)
Hours/Credits	0.5 credit
Lecture plan	Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by a professor and tutors) together with independent self-study (by the student) with the aid of suitable papers (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with the professor (or the tutors). A final presentation/examination of the studied subject is mandatory.
	1 -- Molecular genetic techniques to explore functions of neuronal circuitry ••• 3 Hours
	2 -- Neuronal circuitry of sexual behaviour ••• 6 Hours
	3 -- Physiological significance of nutrient-sensing pathways ••• 3 Hours
	4 -- Regulation of fecundity by seminal fluid ••• 3 Hours

iELST Syllabus (tutorial studies)

No.	**T13**	
Tutorial study title	Tutorial Studies in Plant Developmental Biology	
Main topic of the study	Plant Developmental Biology	
Lecturer	Taku TAKAHASHI	
Contact E-mail	perfect@okayama-u.ac.jp	
Affiliation	Biological Sciences, Graduate School of Environmental, Life, Natural Science and Technology	
position	Professor	
Specialty	Plant developmental biology	
Quarter	(decide after consultation with the students)	
Day	(decide after consultation with the students)	
Period	(decide after consultation with the students)	
Hours/Credits	0.5 credit	
Lecture plan	1 -- Title: Molecular evolution of polyamine biosynthetic genes. 2 -- Title: Diversity of regulatory mechanisms of mRNA translation. 3 -- Title: Principles of detection of polyamines.	
	Several aspects of the topics listed in the above titles are studied by personal tutorial lessons (by professor and tutors) together with independent self-study (by student) with the aid of a suitable textbook and recent literatures (suggested by professor). The tutorial lessons include interactive questions and discussion about the topics with professor (or tutors). A final presentation/examination about the studied subject is mandatory.	•••15 Hours