Course Name(科目名)	Life Science and Systems Engineering Seminar Series			
Instructor Name(担当教員名)	Chair of Technical Committee on Educational Affairs			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	2
Course Description(授業の概要)	In this course, we will invite lecturers from outside the university concerning various topics and give lecture in a seminar style because students should be prepared to have a wide field of view across fields and always keep close attention to trends in the research field and realize new technological innovation in order to become a cutting-edge researcher and engineer in life science and systems engineering. Invited lecturer who are will give a talk on state-of-the-art research trends, exploratory researches, latest social circumstances surrounding life science and systems engineering.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)				
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.	LSSE seminar 1		
	2.	LSSE seminar 2		
	3.	LSSE seminar 3		
	4.	LSSE seminar 4		
	5.	LSSE seminar 5		
	6.	LSSE seminar 6		
	7.	LSSE seminar 7		
	8.	LSSE seminar 8		
	9.	LSSE seminar 9		
	10.	LSSE seminar 10		
	11.	LSSE seminar 11		
	12.	LSSE seminar 12		
	13.	LSSE seminar 13		
	14.	LSSE seminar 14		
	15.	LSSE seminar 15		
General Course Policies(授業の進め方)				
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)			
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	The final grade will be determined by the quality of reports.			
Assignment Instructions (授業外学習(予習・復習)の指示)	Downloading a handout and reading through it once is required. Students must submit the reports on the theme indicated. Students are expected to set aside 4 hours a week as time for class preparation.			
Keywords(キーワード)				
Required Textbooks(教科書)	Textbooks and references will be not used.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.			
Email(電子メールアドレス)				

Course Name(科目名)	Introduction to Green Technology		
Instructor Name(担当教員名)	Kazunori HASEGAWA		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Green Technology which is in harmony with nature is necessary to create sustainable society. Lectureres from Div of Green Technology, Green Electronics, Environmentally Conscious Chemistry and Bioengineering would give you outlook of Green Technology.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Outlook of Power Electronics and Semiconductor Devices	
2.	Characteristics of Power Semiconductor Devices -Static and Switching	
3.	Reliability of Power Semiconductor Devices	
4.	Energy Saving by Power Semiconductor Devices	
5.	Fabrication Process of Silicon Wafer	
6.	Impurity and Lattice Defect of Silicon Wafer	
7.	Quality of Silicon Wafer for Power Semiconductor Devices	
8.	Quality Assessment of Silicon Wafer: Bulk Carrier Lifetime	
9.	Outlook of Solar Cell	
10.	Printable Solar Cell	
11.	Solar Cell Application for Green Technology	
12.	Current situation and Future Trend of Solar Cell	
13.	Current situation and perspectives on the Energy use	
14.	Solid Oxide Fuel Cell Technology	
15.	Hydrogen Production Technology and High Temperature Steam Electrolysis	
16.	Energy technology for zero-emission	

General Course Policies(授業の進め方)		Strongly recommended for attendance of students who belongs to Dept of Biological Funtions Engineering. Mind the schedule to be announced.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. To understand fundamentals and applications of power semiconductor devices 2. To understand fundamentals and applications of the solar cell. 3. To understand the state-of-the-art energy technologies and their problems.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Evaluation based on results of small tests
Assignment Instructions (授業外学習(予習・復習)の指示)		It is recommended to visit each lectures website to know the area of research beforehand. Searching books or website relating to topics of each lectures will be helpful for your better understanding. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords(キーワード)		Power semiconductor devices, solar cells, fuel cells, energy technologies
Required Textbooks(教科書)		Will be introduced in the class.
References/Recommended Reading(参考書)		
Notes(備考)		Usually lectures are given in Japanese. However the teacher will provide documents or slides written in English to those students who need explanation in English.
Email(電子メールアドレス)		

Course Name(科目名)	Introduction to Human Intelligence Systems			
Instructor Name(担当教員名)	Professors/Associate professors of Department of Human Intelligence Systems			
Course intended for(対象学年)	1st or 2nd year student			
Credit Category(単位区分)	Elective and required course		Credits(単位数)	2
Course Description(授業の概要)	Department of Human Intelligence Systems aims to train students to become engineers/researchers who can solve social problems through researches related to development of intelligent mechanical systems, artificial intelligent systems, brain science and principles of human reasoning. This course intends to provide students with basic knowledge to understand other specialized courses. This course will be provided by four divisions as following; Human Intelligence and Machines, Intelligence Systems and Emergent Design, Human Interaction and Brain Functions, and Human Behavioral Sciences.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course is aiming to provide the students with the basic knowledge/concept of the researches performed in the Department of Human Intelligence Systems.			
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.			
	2.			
	3.	1-6: Basic knowledge, latest research topics, test of Human Intelligence and Machines Division	1-6: Brain-like integrated systems, Morion control system, Intelligen	
	4.			
	5.			
	6.			
	7.			
	8.	7-11: Basic knowledge, latest research topics, test of Intelligence Systems and Emergent Design Division	7-11: Learning theory of higher-order self-organizing intelligence, H	
	9.			
	10.			
	11.			
	12.			
	13.	12-16: Basic knowledge, latest research topics, test of Human Interaction and Brain Functions Division	12-16: Neural rhythm and brain computer interface BCI, Team mana	
	14.			
	15.			
General Course Policies(授業の進め方)	Each topic will be lectured by professor/associate professor of the Department of Human Intelligence Systems.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	At the end of the course, participants are expected to explain the basic knowledge/concepts for the Department of Human Intelligence Systems.		
	Couse objectives (具体的な授業の達成目標)	1. Explaining the basic knowledge. 2. Explaining the basic concepts of research. 3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Evaluation will be done by the summation of tests.			
Assignment Instructions (授業外学習(予習・復習)の指示)	The students are expected to review all contents/keywords presented in the course. Students are expected to set aside 4 hours a week as time for class preparation.			
Keywords(キーワード)	Human intelligence, Intelligence system, Human interaction, Brain function			
Required Textbooks(教科書)	Will be lectured in the course.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.			
Email(電子メールアドレス)	Professors/Associate professors of Department of Human Intelligence Systems			

Course Name(科目名)	G2E2 Seminar	Class(クラス番号)	
Lecturer(担当教員)	Akihiko Watanabe		
Course intended for (対象学年)	1st or 2nd year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This seminar provides advanced research on environmental and energy-related problems existing in our modern society by overseas and domestic researchers , which demands for the realization of green, clean, and sustainable growth. It also aims to nurture global leaders, who can not only become a bridge between techno-scientific societies of Japan and abroad but also actively play their role towards providing amicable solutions for various issues related to the energy and environment.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Courses in gree electronics fields are related to this course.		

Course Calendar/Class Topic (授業計画)

	Theme(テーマ)	Contents(内容)
1.	Introduction	
2.	Overseas advanced research on on	
3.	Overseas advanced research on on	
4.	Overseas advanced research on on	
5.	Domestic advanced research on on	
6.	Domestic advanced research on on	
7.	Domestic advanced research on on	
8.	Group discussion (1)	
9.	Overseas advanced research on on	
10.	Overseas advanced research on on	
11.	Overseas advanced research on on	
12.	Domestic advanced research on on	
13.	Domestic advanced research on on	
14.	Domestic advanced research on on	
15.	Group discussion (2)	

General Course Policies(授業の進め方)	Following the above.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. To understand overseas advanced research on on environmental and energy-related problems.
		2. To understand domestic advanced research on on environmental and energy-related problems.
		3. To understan overseas advanced research on on green-electronics technologies
		4. To understan domestic advanced research on on green-electronics technologies
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Evaluation based on results of small tests	
Assignment Instructions (授業外学習(予習・復習)の指示)	Survey the Web site of lecturer of each theme, pick up keywords in the site, and then find what you want to study and what you want to ask. In addition, investigate keywords given by lecturerers and then deeply understand the themes.	
Keywords(キーワード)	Environmental and energy-related problems, green electronics, energy use	
Required Textbooks(教科書)		
References/Recommended Reading(参考書)		
Notes(備考)	This seminar is required to finish the G2E2 cource.	
Email(電子メールアドレス)		

Course Name（科目名）	Advanced Electrochemical Technology		
Instructor Name(担当教員名）	Shyam S. PANDEY		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Description（授業の概要）	Electrochemical processes are omnipresent in both of living and non-living systems. Aim of this course is to introduce the power of electrochemistry from fundamental levels to advanced applications starting from the basic concepts of electrochemstry and electrochemical processes and ending to their utilization towards the applications in the diverse field of advanced technologies.		
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	Prior knowledge about the course contents is although not necessary, but fundamental knowledge of Chemistry, Electrochemistry and Materials Science will make the students comfortable for the easy understanding and facile grasping of the lecture contents.		

Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）
	1.	Fundamentals of Electrochemistry-I	Acquire the knowledge about fundamental concepts of electrochemi
	2.	Fundamentals of Electrochemistry-II	Acquire the knowledge about fundamental concepts of electrochemi
	3.	Electrochemical Techniques-I	Explain about various techniques used in the electrochemistry.
	4.	Electrochemical Techniques-II	Explain about various techniques used in the electrochemistry conti
	5.	Electrochemical Techniques-III	Explain about various techniques used in the electrochemistry conti
	6.	Technological Applications of Electrochemistry-I	Applications with emphasis for conducting polymers and soft actuat
	7.	Technological Applications of Electrochemistry-II	Applications in area of advanced manufactutring and super capacito
	8.	Electrochemistry and Dye-Sensitized Solar Cells（DSSCs）	Explai in detail about the role of electrochemistry in DSSC research
	9.	Electrochromic Devices	Explain about application in electrochromic materials and devices.
	10.	Electrochemical Sensors	Learn about application of electrochemistry in chemical sensing.
	11.	Electrochemical Biosensors	Explain about the biosensing and involvement of electrochemistry in
	12.	Electrochemiluminiscent Devices	Explain about electrochemical light emission and devices based on it
	13.	Primary Cells and Secondary Batteries	Explain in detail about galvanic cells and batteries.
	14.	Fuel cells-I	Explain in detail about construction of different type of fuel cells.
	15.	Fuel cells-II	Construction different type of fuels and latest development in the fi
	16.	Final Summary	Final summary and outlook of the whole course.

General Course Policies（授業の進め方）		3 tests will be conducted for evaluation and each of the lecture material will be uploaded on the live campus in advance.
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	To provide fundamental knowledge of electrochemistry from the viewpoints of various processes and techniques involved. Application of electrochemistry in the diverse field of cutting edge technologies will be introduced.
	Couse objectives （具体的な授業の達成目標）	1. To acquire knowledge about electrochemical science and technology. 2. To learn about various processes and techniques in electrochemitsry. 3. To apply the electrochemical processes in diverse field of advanced technologies.
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）		Evaluation will be carried out based on performance during lectures, results of small tests and final report summarization.
Assignment Instructions （授業外学習（予習・復習）の指示）		Students are advised to have prior study using related keywords before attending the lectures. During the course of the lectue, problems for self study will also be provided followed by evalution.
Keywords（キーワード）		Electrochemistry, Electrochemical techniques, Electrochemical sensors, Industrial electrochemistry, Dye-Sensitized Solar Cells, Electrochromism, Electrochemiluminescence Super capacitors, batteries and fuel cells.
Required Textbooks（教科書）		Nothing specifically. If necessary, information about additional study will be provided at the end of the respective lectures.
References/Recommended Reading（参考書）		Students will be suggested for suitable references during the lectures depending on need.
Notes（備考）		Lectures will uploaded on the live campus in advance before the commencement of the respctive lectures. This will help the students for their prior studey before the lecture.
Email（電子メールアドレス）		shyam@life.kyutech.ac.jp

Course Name(科目名)	Nano materias and energy conversion		
Instructor Name(担当教員名)	Tingli Ma		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Introduction of globe warming, solar energy and solar cells, including types, structures, work pricinples, advatages and disadvantages of Si, CIGS, CdTe, and new concept solar cells. The lecture also introduce the batteries, such as Li- ion and Na-ion batteries, Fuel Cells		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course is the first step to undstand fundamental knowledge about solar energy conversion and metal batteries. It is needed the basic electrodechemical knowledge. This course is very importante for learning renewable energy and their application.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Globe warming and introduction of solar cell research	
	2.	Sicon solar cells	
	3.	CIGS and CZTS solar cells	
	4.	CdTe and multijunction solar cells	
	5.	Dye-sensitized solar cells	
	6.	Organic solar cells	
	7.	Perovskite solar cells	
	8.	Progress in new concept solar cells	
	9.	Nano materials and their applications	
	10.	Carbon materials and their applications	
	11.	Photocatalysts and their application	
	12.	Electrochemical catalystes and fuel cells	
	13.	Li-ion and Na-ion batteries	
	14.	Metal air batteries	
	15.	Supercapacitors	
	16.	Summary and reports	

General Course Policies(授業の進め方)	Search and learn the backgroud and fundamental knowledge before each lecture	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Understand the structure and principle of several solar celles, such as Si , dye-sensitized , and 2. Learn the structure and work principle of metal batteries, such as Li, Na, Mg-batteries, also metal air 3. Understand the advantage and disadvantages of solar celles and metal ion batteries.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Lecture 40%; Report:60%	
Assignment Instructions (授業外学習(予習・復習)の指示)	Review after lecture Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)	Solar energy conversion; metal ion battery; nanomaterials	
Required Textbooks(教科書)	PPT	
References/Recommended Reading(参考書)	Solar cell, Li ion battery, Fuel cell	
Notes(備考)	Japanese／English	
Email(電子メールアドレス)	tinglima@life.kyutech.ac.jp	

Course Name（科目名）	Applied power electronics			
Instructor Name(担当教員名）	Tsuyoshi Hanamoto			
Course intended for（対象学年）	1st year student			
Credit Category（単位区分）	Elective course		Credits（単位数）	2
Course Description（授業の概要）	Electrical energy is one of the important energy for human society because it can change to other kinds of energy with fast response and easy to control. Power electronics is the technology to control the electrical power using the power semiconductor ,and it can achieve the high efficiency and high, precision control simultaneously. In this class, applied power electronics technology is lectured, for example power conversion and motor drive control.			
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	The aim of this course is that deepen understanding of power electronics technology. Mainly, the principle operation of inverter and variable speed control of AC motor, which is one of the typical application of power electronics is lectured.The basic knowledge of electrical machine, control theory, energy converson, basic of power electronics are desired for better understanding of the course.			
Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）	
	1.	Introduction of power electronics	Introduction of the coure and histrical background are lectured	
	2.	Power Semiconductor devices	Principle operation of power semiconductor as a switch are lectured	
	3.	DC-DC conversion	DC to DC power conversion using several type of the converter is l	
	4.	DC-AC conversion(single phase inverter)	DC to AC power conversion of single phase inverter is lectured	
	5.	DC-AC conversion(three phase PWM inverter)	DC to AC power conversion of three phase inverter is lectured	
	6.	Principle of the electrical motors	Principle of electrical to mechanical conversion and the structure o	
	7.	Coordinate transformation and mathematical model of AC motor	Mathematical model of both DC and AC motors are lectured	
	8.	Control method of the motor driving (Vector control)	Variable speed control of the motor and the equivalent circuit of AC	
	9.	Control system design(laplace transformation and state space equation)	Principle of transfer function and state space equation for motor co	
	10.	Control system design (feedback control)	Feedback control with PID controller and other types of the control	
	11.	Torque control and speed control using observer theory	Full order state space observer and its application are lectured	
	12.	Minimum order observer and applied the disturbance compensation	Minimum order state space observer and its application are lectured	
	13.	Observer based position sensorless control	Position sensorless control using observer of PMSM are lectured	
	14.	Applied power electronics to the Electrical Vehicle	Power electronics technology to the electrical vehicle are lectured	
	15.	Conclusion of the lecture	conclude of the course	
General Course Policies（授業の進め方）	The couese uses the power point presentation which can be downloaded from "LiveCanpus". MATLAB/Simulink is used to understand the principle the theory. Also the the demo version of the simulation software for the power electronics and control design are used inthe class; "PSIM" and "Scilab". Download and try to use them by yourselves. Breaf instruction of these software are explained in the class.			
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	Well understanding that high performance and high efficiency control are achieved simultaneously employed power electronics technology		
	Couse objectives （具体的な授業の達成目標）	1. understanding of the principle and operation of the three phase inverter 2. understanding of the principle of the permanent magnet synchronous motor (PMSM) and variable speed 3. implement and simulate of power electronics system using MATLAB/Simulink or PSIM simulator		
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）	Class attendance and attitude in class/ Some reports			
Assignment Instructions （授業外学習（予習・復習）の指示）	Download and read the documents of the class from Live campus . Simulate and check the circuits explained in the class. Students are expected to set aside 4 hours a week as time for class preparation.			
Keywords（キーワード）	power conversion, power semiconductor device, inverter, motor control, VVVF(variable voltage variable frequency)			
Required Textbooks（教科書）	All the documents of the class can be downloaded from "Live campus".			
References/Recommended Reading（参考書）				
Notes（備考）	Usually lectures are given in English.			
Email（電子メールアドレス）	hanamoto@life.kyutech.ac.jp			

Course Name(科目名)	Organic Electronic Materials and Devices		
Instructor Name(担当教員名)	Shyam S.PANDEY		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Organic Electronics is fast growing area dealing with the utilization of organic semiconductors aiming towards the development of relatively greener, flexible and wearable electronic devices. This course deals with fundamental concepts on organic semiconductors along with the introduction of different electronic devices starting from their origin to latest development taking both of the materials and device aspects in to consideration.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Prior knowledge about the course contents is although not necessary, but fundamental knowledge of Chemistry, Material Science, Electronics and Device Physics will make the students comfortable for understanding and enjoying the lectures planned under this course.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Overview of the course	Explain the course overview, Need and importance of organic electr
	2.	Fundamentals of organic semiconductors-I	Organic semicondutor basics, classifications, structural aspects.
	3.	Fundamentals of organic semicondcutors-II	Organic semicondutor basics, intermolecular interactions and doping
	4.	Organic semicondcutors: Design & Synthesis	Explain about design rules and preparation of organic semiconductor
	5.	Organic semicondcutors: Thin Film Fabications	Detailed study about various techniques used for thin film fabricatio
	6.	Organic semicondcutors: Thin film Characterizations	Explain about various methods/tools used for thin film characterizat
	7.	Organic semicondcutors: Charge transport	In-depth discussion about the various charge transport phenomena.
	8.	Two terminal devices: Diodes and Photodiodes	Fabrication and characterization of diodes and photodiodes.
	9.	Two terminal devices: Photodiodes and Memristors	Fabrication and characterization of photodiodes and memory device
	10.	Two terminal devices: Solar cells	Fabrication, characterization and latest development in organic solar
	11.	Three terminal devices: Organic Field effect Transistors (OFETs)	Detailed explanation about OFETs from materials to device aspects.
	12.	Three terminal devices: Phototransistors	Explain in detail about phototransistors & advancement in the resea
	13.	Integrated Organic Electronic Devices/circuits-I	Fundamental concepts of organic CMOS circuits and logic gates.
	14.	Integrated Organic Electronic Devices/circuits-II	Organic CMOS circuits and logic gates present state-of-art and fut
	15.	Emerging Hybrid Organic Electronic Devices	Dealing with organic devices having capability of multiple functions.

General Course Policies(授業の進め方)	3 tests will be conducted for evaluation and study materials for every lecture will be uploaded on the live campus in advance in order to help your prior self-study before coming to the class.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	To provide basic knowledge about organic semiconductors along with their applications for various electronic devices having capability of large area and low cost production in combination with light weight and flexibility.
	Couse objectives (具体的な授業の達成目標)	1. To acquire knowledge about organic semiconductors along with involved electronic and photonic 2. To learn about different techniques for the fabrication and characterization of organic electronic 3. To get insight about various organic optoelectronic devices along with recent advancement in that field.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Evaluation will be based on performance during lectures, results of small tests and final report summarization at the end of the course.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are advised to have prior study of the lecture consudering the suitable keywords before attending the lectures. During the course of the lectue, problems for self study will also be provided folloed by evalution.	
Keywords(キーワード)	Organic semiconductors, conjugated polymers, charge transport, organic electronics, device physics, organic circuits, photo-physics, multi-functional devices.	
Required Textbooks(教科書)	Nothing specifically. If necessary information about additional study will be provided at the end of the every onging lectures.	
References/Recommended Reading(参考書)	Students will be suggested for suitable references during the lectures depending on need.	
Notes(備考)	Lectures will uploaded on the live campus in advance before the commencement of the respctive lectures. This will help the students for their prior studey before the lecture.	
Email(電子メールアドレス)	shyam@life.kyutech.ac.jp	

Course Name(科目名)	Micro total analysis systems		
Instructor Name(担当教員名)	Momoko KUMEMURA		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Micro total analysis systems (MicroTAS) or Lab-on-a-chip are miniaturized devices to perform reaction/detection of trace amounts of chemicals or biological materials. The objective of this class is to understand MicroTAS comprehensively.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	The class will provide knowledge of methods for chemical/biological analysis. This class focuses on the basics and the applications of chip-based microfluidic systems and does not include Micro Electro Mechanical Systems (MEMS). It is recommended to take "Bio-MEMS (Professor Yasuda, First quoter)" for further understanding.		

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Outline of this class	
2.	History of MicroTAS researches, Characteristics of micro space	
3.	Molecular transportation and chemical reaction	Consider molecular transportation in micro space by comparing it as
4.	Characteristics of microfluidics, Flow control	As a characteristic fluid flow occurred in a microchannel, laminar flo
5.	Conventional analytical methods for chemicals	The basics of analytical methods will be explained to understand and
6.	Practical experimental set-up for MicroTAS	The required/optional external devices, which are used to conduct e
7.	Research examples of MicroTAS	
8.	Intermediate test	
9.	Materials and fabrication methods	
10.	Surface treatments of	
11.	Conventional analytical methods for biosamples	The major bioanalytical methods which are frequently applying to Mi
12.	Electrophoresis chip and DNA chip	
13.	Research examples of MicroTAS for bioanalysis (1)	
14.	Research examples of MicroTAS for bioanalysis (2)	
15.	Terminal examination	

General Course Policies(授業の進め方)	The class will be spoken in Japanese using slides and blackboard. English text will be added to the slides. Small tests or small homework may be given.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The objective of this class is to understand MicroTAS comprehensively.
	Couse objectives (具体的な授業の達成目標)	1. Understand the idea of MicroTAS, characteristics of micro space, and fluid. 2. Understand the experimental-flow of chemical analysis. Understand the basics of the major separation 3. Able to choose a suitable method and technique for the determination of an analyte using MictoTAS.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	The grade will be based on the sum of the scores of the intermediate test and the terminal examination.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)	Micro total analysis systems, MicroTAS, Analytical methods	
Required Textbooks(教科書)		
References/Recommended Reading(参考書)		
Notes(備考)	If one needs to take the class in English, please contact the lecturer.	
Email(電子メールアドレス)	momo@life.kyutech.ac.jp	

Course Name(科目名)	Electric Energy Conversion Technology		
Instructor Name(担当教員名)	Kazunori HASEGAWA		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This course provides electric energy conversion technology based on power theory of alternating current (AC) circuits and power electronic converters that interfaces with AC circuits.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Applied power electronics, Semiconductor Power Devices, Measurement and evaluation for electronics are related to this course.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Fundamentals of Electric Energy	
	2.	Fundamentals of AC Power	
	3.	Single-Phase AC Power	
	4.	Three-Phase AC Power	
	5.	Instantaneous Power Theory	
	6.	Fundamentals of Inverters	
	7.	Control of Inverters	
	8.	Adjustable-Speed Control of AC Motors	
	9.	Renewable Energy Resources	
	10.	Power Quality	
	11.	Multilevel Converters	
	12.	Design of Inductors and Transformers	
	13.	Design of DC-Link Capacitors	
	14.	State-of-the-Art Power Electronic Tecnologies	
	15.	Conclusion	

General Course Policies(授業の進め方)	Following the above.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. To understand theory of three-phase AC power. 2. To understand theory and design procudure of inverters. 3. To understand theory and design procudure of passive components.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Results of exercises and mini tests during the course.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Preperations of the flollowings are recommended: ・Fundamental knowledge of electric circuit, electromagnetism, electric machinery, and power electronics. Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)	Three-phase AC power, inverters, power electronics, passive components, grid-tied applications.	
Required Textbooks(教科書)	Commercially available textbooks are not used. Documents will be provided and referenceres will be introduced for each topic.	
References/Recommended Reading(参考書)	H. Akagi, E. H. Watanabe, and M. Aredes, "Instantaneous Power Theory and Applications to Power Conditioning," IEEE Press B. Wu, "High-Power Converters and AC Drives," IEEE Press	
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)	hasegawa@life.kyutech.ac.jp	

Course Name(科目名)	Bio-MEMS		
Instructor Name(担当教員名)	Takashi Yasuda		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	MEMS (Micro Electro Mechanical Systems) are micron-size structures and their integrated systems which are fabricated using microfabrication such as semiconductor processing. MEMS for biomedical applications are called "Bio-MEMS", and include microdevices for blood testing, cell analysis, drug discovery, etc. In order to help students acquire basic knowledge of Bio-MEMS, this course will start with microfabrication techniques followed by MEMS examples such as microactuators and microsensors, and give detailed explanations over structures, principles, and applications of various Bio-MEMS.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course is designed to foster interdisciplinary perspective, and provides broad knowledge to any student who majors in mechanical engineering, electrical engineering, material science, or applied chemistry. Also, this course includes basic contents for preparing students to take the course "Micro total analysis systems."		

Course Calendar/Class Topic (授業計画)

	Theme(テーマ)	Contents(内容)
1.	Introduction: What is MEMS?	Definition and examples of MEMS
2.	Basic microfabrication technique	Surface micromachining, Bulk micromachining
3.	3D microfabrication technique	Deep RIE, LIGA process, Soft lithography, Stereolithography, FIB
4.	Scale effect and electrostatic microactuators	Scale effect on various forces, Various electrostatic microactuators
5.	Microactuators	Piezoelectric actuators, Photostrictive actuators, Magnetostrictive
6.	Neural interfaces	Fundamentals of bioelectrical signal measurement, Penetrating elect
7.	Physical microsensors (1)	Pressure sensors, Acceleration sensors
8.	Physical microsensors (2)	Angular velocity sensors, Flow sensors, Temperature sensors
9.	Chemical microsensors and microfluidic devices	ISFET, Lab on a Chip, Healthcare chip
10.	Cell analysis devices	Cell stimulation devices, Co-culture devices, Extracellular potential
11.	Microliquid handling devices	Droplet transportation using wettability gradient, Electrowetting, Sup
12.	Electrostatic manipulation of biological samples	Cell manipulation and blood separation using dielectrophoresis, Elect
13.	Biomolecule detection devices (1)	Electrochemical measurement, LSPR-based biosensing
14.	Biomolecule detection devices (2)	QCM detection, Fluorescence detection
15.	Final examination	
16.	Review	Answers of the final examination

General Course Policies(授業の進め方)	Each lecture is given with a PowerPoint presentation limited to one theme. A short quiz is given during each lecture to assist understanding.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	By the end of the course, students are expected to:
	Couse objectives (具体的な授業の達成目標)	1. Understand and explain microfabrication techniques and scaling effect in miniaturization. 2. Understand and explain principles and properties of physical/chemical microsensors. 3. Understand and explain fundamentals and possibilities of biomedical techniques using MEMS.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	The final grade will be determined by quality of brief reports during lectures (50%) and score of final examination (50%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	For better understanding, key words in the course materials should be researched on the Internet prior to each lecture, and a review of each lecture should be carried out using literatures referred to in the course materials. Students are expected to set aside 4 hours a week as time for class preparation and review.	
Keywords(キーワード)	MEMS (Micro Electro Mechanical Systems), Microfabrication, Scale effect, Microactuator, Microsensor, Bio-MEMS, Microfluidic device, Cell analysis, Microliquid handling, Electrostatic manipulation, Biomolecule detection	
Required Textbooks(教科書)	No textbooks are assigned.	
References/Recommended Reading(参考書)	The course materials must be downloaded from LiveCampus prior to each lecture. Reference literatures are given within.	
Notes(備考)	The course will be taught in Japanese. All of the course materials are written in English. For students who need lecture in English, language assistance is negotiable.	
Email(電子メールアドレス)	yasuda@life.kyutech.ac.jp	

Course Name(科目名)	Biomechanical dynamics		
Instructor Name(担当教員名)	Kazuto Takashima		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This course introduces the structure, the function and the response of human body parts from the viewpoint of dynamics of machinery and design of machine elements. Dynamics of machinery deals with the motion of a rigid body and the dynamic properties of a machine. It is important to understand not only the static but also the dynamic behaviors of the human body parts.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction	
	2.	Motion of rigid body 1 (equations of motion and mechanism)	
	3.	Motion of rigid body 2 (basic mathematics)	
	4.	Motion of rigid body 3 (dynamics of skeletal muscle)	
	5.	Motion of rigid body 4 (nerve)	
	6.	Motion of rigid body 5 (numerical analysis)	
	7.	Vibration 1 (introduction)	
	8.	Vibration 2 (effect of sound wave on living tissue)	
	9.	Vibration 3 (skin and tactile sense)	
	10.	Vibration 4 (tactile sensor)	
	11.	Machine element 1 (introduction)	
	12.	Machine element 2 (friction and lubrication in human joint)	
	13.	Machine element 3 (circulatory organ)	
	14.	Measurement of living tissue 1 (basic)	
	15.	Measurement of living tissue 2 (application)	

General Course Policies(授業の進め方)		Students are not necessarily required to have the knowledge of dynamics of machinery and design of machine elements because the basics are explained first. Quiz is conducted after each lecture and the answer is explained at the beginning of the next lecture.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	By the end of the course, students are expected to:
	Couse objectives (具体的な授業の達成目標)	1. understand the structure, the function and the response of human body parts from the viewpoint of 2. acquire the knowledge about the application of "Biomechanical dynamics" in diverse field of advanced 3.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Grading will be decided based on the following: - Quizzes in each class, - Final exam (or final paper).
Assignment Instructions (授業外学習(予習・復習)の指示)		We recommend to read the material provided before each class, and review the lecture content to help understand the class. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords(キーワード)		
Required Textbooks(教科書)		Text books are not used. Materials are provided before each class.
References/Recommended Reading(参考書)		References will be introduced before each class.
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		ktakashima@life.kyutech.ac.jp

Course Name(科目名)	Biomechanics		
Instructor Name(担当教員名)	Hiroshi Yamada		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	A human body is subjected to external and internal forces, and some functions and behaviors of body components can be dealt as mechanical phenomena. By revealing the correlations between biological phenomena and mechanical factors, one can enhance healthy conditions and protect the body from disorders and diseases with an aid of engineering. This class introduces the methods in solid biomechanics to evaluate or analyze the structures, functions and responses of human body components to learn the mechanical characteristics of musculoskeletal and cardiovascular systems, etc. It also introduces some approaches to the body components with engineering discipline.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Overview of biomechanics and related fields	
	2.1	Fundamentals of Newtonian mechanics and weightlessness	
	2.2	Static force applied to the musculoskeletal system	
	3.1	Basic theory of strength of mechanics for hard tissues with infinitesimal strain	
	3.2	Mechanical characteristics of bones and teeth (normal and impaired cases)	
		Summary of Chapter 1 to Section 3.2 and research learning	
	4.1	Fundamentals of viscoelastic theory	
		Individual investigation and presentation (Chapter 1 – Section 4.1)	
	4.2	Visoelasticity of soft tissues	
	4.3	Mechanical characteristics of skeletal muscles with active contraction	
	4.4	Fundamentals of continuum mechanics for soft tissues with large strain	
	4.5	Mechanics of cardiovascular system (physiological functions)	
	4.6	Mechanics of cardiovascular system (aging and disease)	
	4.7	Dynamic characteristics of living tissues with impact	
	5.	Mechanical tests and finite element analyses for cells and tissues	
		Individual investigation and presentation (mechanical properties of soft tissues and cells)	

General Course Policies(授業の進め方)	It is imortant to understand the mechanics. Basics of Newtonian mechanics, strangth of materials and continuum mechanics are explained in the class. Each short report should be submitted by the end of each class.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Understanding of the roles of biomechanics 2. Understaniding of the correlations between biomehcanical behaviors and mechanical laws 3. Derivation and evaluation of force, stress and strain in human body parts (organs, tissues and cells)
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class will be decided based on short reports in each class (40%) and presentations and reports of investigations (60%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	As preparations, students need to study fundamentals of Newtonian mechanics, strength of materials and contiuum mechanics. As reviews, students need to understand the mechanical characteristics of living tissues deeply. You also need to study for individual investigations and presentations.	
Keywords(キーワード)	Biomechanics, force, deformation, stress, strain	
Required Textbooks(教科書)	Textbook: H. Yamada, Fundamentals of mechanics and biomechanics, in Jap (ISBN 978-4-339-07230-3) Materials are provided and references are introduced in each class.	
References/Recommended Reading(参考書)		
Notes(備考)	Lectures are given in Japanese. However lectures with mateials and oral explanations in English will be given if there are students who need explanation in English.	
Email(電子メールアドレス)		

Course Name（科目名）	Functional Biomaterials		
Instructor Name(担当教員名）	Toshiki Miyazaki		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Description（授業の概要）	This course deals with structure, design and development of biomaterials used for medical fields. Especially this course focuses on hard tissue repair such as bone and tooth. Ceramics, metals, polymers and composites materials for biomaterials will be introduced.		
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	It is desired to learn subjects on biomaterials, inorganic chemistry and polymer chemistry in undergraduate course.		

Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）
	1.	What is biomaterial?	
	2.	Current development process and production of biomaterials	
	3.	Structure and function of bone	
	4.	Structure and function of tooth	
	5.	Interaction between biomaterial and body	
	6.	Cytotoxicity of various elements	
	7.	Ceramic biomaterials	
	8.	Polymer biomaterials	
	9.	Composite biomaterials	
	10.	Metallic biomaterials	
	11.	Ceramics produced by living things	
	12.	Principle of biomimetic process	
	13.	Development of biomaterials and environmental materials by biomimetic process	
	14.	Biomaterials for tissue engineering	
	15.	Biomaterials for cancer treatment	

General Course Policies（授業の進め方）		Powerpoint is used. Small quiz is also performed in the class.
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	90-100 or A (Passed): Excellent 80-89 or B (Passed): Good 70-79 or C (Passed) : Satisfactory
	Couse objectives （具体的な授業の達成目標）	1. Properties of biomaterials can be explained. 2. Preparation of biomaterials can be explained. 3. Chemical structure of biomaterials can be explained.
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）		Reports in each class and final exam
Assignment Instructions （授業外学習（予習・復習）の指示）		Students should read English handout distributed by PDF file in advance. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords（キーワード）		Biomaterials, Biocompatibility, Ceramics, Polymers, Metals
Required Textbooks（教科書）		Textbook is not used.
References/Recommended Reading（参考書）		L.L. Hench (ed.), "An Introduction to Bioceramics (2nd Edition)", Imperial College Press, 2013 T. Kokubo (ed.), "Bioceramics and their Clinical Applications", Woodhead Publishing, 2008
Notes（備考）		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email（電子メールアドレス）		tmiya@life.kyutech.ac.jp

Course Name(科目名)	Materials Design		
Instructor Name(担当教員名)	Satoshi Iikubo		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	The function of the materials depends on the microscopic structure. Therefore, we need the information about the structure, and its stability in order to design nobel eco-friendly materials. The purpose of this course is to help students understand the materials design, and the useful simulation techniques.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Introduction: Design for environmentally friendly materials	
2.	Introduction: Simulation method	
3.	Crystal structure	
4.	Crystal structure and electron	
5.	Schrödinger equation (1)	
6.	Schrödinger equation (2)	
7.	First-principles calculation (1)	
8.	First-principles calculation (2)	
9.	Moleculer dynamics (1)	
10.	Moleculer dynamics (2)	
11.	Calphad method (1)	
12.	Calphad method (2)	
13.	Calculation of lattice vibration	
14.	Cluster expansion and Cluster variation method	
15.	Review	

General Course Policies(授業の進め方)		
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	Purpose of this class is to learn simlation method for the materials design.
	Couse objectives (具体的な授業の達成目標)	1. First-principles calculation 2. Moleculer dynamics 3. Calphad method
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Your final grade will be calculated according to the following process: Short examination (50%), and a fraction of in-class contribution
Assignment Instructions (授業外学習(予習・復習)の指示)		The students are expected to review all keywords presented in the class. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords(キーワード)		
Required Textbooks(教科書)		Will be introduced in the class.
References/Recommended Reading(参考書)		
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		

Course Name(科目名)	Biorobotics		
Instructor Name(担当教員名)	Tomohiro Kawahara		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Investigation of the characteristics of organs, tissues, cells, and molecules is quite important for understanding the unknown mechanisms of living organisms and to develop state-of-the-art biomedical robots. In this class, design, fabrication, mechanism, and application of recent biorobots are introduced and discussed.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Overview of Biorobotics	Introduction and classification of biorobotics.
2.	Fundamentals of Robotics	Basic theory of robot control.
3.	Medical Robot I	History, basic theory, and design of medical robot.
4.	Medical Robot II	Fabrication and control method of medical robot.
5.	Bio-inspired Robot I	History, basic theory, and design of bio-inspired robot.
6.	Bio-inspired Robot II	Fabrication and control method of bio-inspired robot.
7.	Soft Robot I	History, basic theory, and design of soft robot.
8.	Soft Robot II	Fabrication and control method of soft robot.
9.	Micro Robot I	History, basic theory, and design of micro robot.
10.	Micro Robot II	Fabrication and control method of micro robot.
11.	Nano Robot I	History, basic theory, and design of nano robot.
12.	Nano Robot II	Fabrication and control method of nano robot.
13.	Wet Robot I	History, basic theory, and design of wet robot.
14.	Wet Robot II	Fabrication and control method of wet robot.
15.	Summary	Summary and future direction of biorobotics.

General Course Policies(授業の進め方)		
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Understanding of history and background in Biorobotics field. 2. Understanding of cutting edge technology and problems in Biorobotics filed. 3. Active discussion related to technologies in Biorobotics.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class will be decided based on short reports in each class and term-end examination.	
Assignment Instructions (授業外学習(予習・復習)の指示)	It is highly recommended to search related keywords in the handout before the class. It will support your better understanding. Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)		
Required Textbooks(教科書)	Text books are not used. Handout is provided before each class.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)	kawahara@lsse.kyutech.ac.jp	

Course Name（科目名）	Biological Recycling			
Instructor Name(担当教員名）	Minato WAKISAKA			
Course intended for（対象学年）	1st year student			
Credit Category（単位区分）	Elective course		Credits（単位数）	2
Course Description（授業の概要）	This course deals with the sustainability issues of biomass utilization.			
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	This course offers fundamental knowledge of sustainability issues which are essential for global engineer.			

Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）
	1.	Earth Structure and Biochemical Cycle	Introduction of fundamentals of Biochemical Cycle on Earth
	2.	Ecosystem and Biochemical Cycle	Introduction of fundamental role of Biochemical Cycle in Ecosystem
	3.	Plant Biomass and Ecosystem	Introduction of Plant Biomass and its contribution to Ecosystem
	4.	Ecological Connectivity and its Linkages with Human Activities	Introduction of Human Activities Impact on Earth
	5.	Biodiversity	Introduction of Biodiversity and guidance on why it matters
	6.	Interrelationship between Ecosystems and Human Activities(Food)	Lecture on Sustainablitiy issues on Food
	7.	Interrelationship between Ecosystems and Human Activities(Life Style)	Lecture on Sustainablitiy issues on Human Life Style
	8.	Interrelationship between Local Ecosystems and Human Activitie	Lecture on Local Sustainablity Issues
	9.	Interrelationship between Global Ecosystems and Human Activities	Lecture on Global Sustainablity Issues
	10.	Essence of Global Environment Issues	Summary of Global Sustainable Issues
	11.	Biomass Resources for Sustainable Society	Lecture on Sustainable Biomass Utilization
	12.	Biomass Energy for Sustainable Society	Lecture on Biomass utilization as Energy
	13.	Biomass Material for Sustainable Society	Lecture on Biomass utilization as Material
	14.	Biomass Utilization and Social System Design in Japan	Summary of social system design for local sustainability
	15.	Biomass Utilization and Social System Design of World	Summary of social system design for global sustainability

General Course Policies（授業の進め方）		Basic knowledge about chemstry and biology are necessary.	
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	Understanding sustainablity issues and biomass utilization as one of their countermeasures.	
	Couse objectives （具体的な授業の達成目標）	1.	Understanding sustainablity issues and biomass utilization
		2.	
		3.	
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）		Grading will be decided based on attendance, reports, and a fraction of in-class contribution.	
Assignment Instructions （授業外学習（予習・復習）の指示）		It is recommended to search for keywords of each lecture beforehand. Reading assighments will be helpful for your better understanding. Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords（キーワード）		Sustainability, Biomass	
Required Textbooks（教科書）		No specific textbook will be used	
References/Recommended Reading（参考書）		Will be introduced in the class.	
Notes（備考）		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email（電子メールアドレス）		wakisaka@life.kyutech.ac.jp	

Course Name(科目名)	Functional Interface Engineering		
Instructor Name(担当教員名)	Professor Tetsuya HARUYAMA, PhD		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This lecture introduces the Functional Interface Engineering to study taking this lecture. the Functional Interface Engineering is an engineering academic field which includes chemistry, electrochemistry, molecular science, analytical chemistry: and physical chemistry.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	General introduction of the Functional Interface Engineering	
	2.	Electron and organic molecules	
	3.	Element of electrochemical reactuon 1	
	4.	Element of electrochemical reactuon 2	
	5.	Element of catalytic electrochemical reaction	
	6.	Electrochemical biosensors: Case study of R&D	
	7.	Element of mammalian cell	
	8.	Cultured cell based biosensors: Case study of R&D	
	9.	Functional modulation of cellular function: Case study of R&D	
	10.	Element of molecular functions	
	11.	Functional Interface Engineering	
	12.	Interigent materials 1: Case study of R&D	
	13.	Interigent materials 2: Case study of R&D	
	14.	Novel chemical reaction locus at gas/liquid interface: Case study of R6D	
	15.	General summarize of the Functional Interface Engineering	

General Course Policies(授業の進め方)		Prohibited voice recording, video recording and photographing.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	Participants will learn to think about the basic science and industrial technology by understanding the engineering significance of each event, in addition to understanding the events taken up in each lecture.	
	Couse objectives (具体的な授業の達成目標)	1. Understand the chemical or physicochemical events discussed in each lecture. 2. Engineering significance of each event. 3. Linking basic science and industrial technology.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Final grade of you will be decided accordong to quiz which is held in the every lecture	
Assignment Instructions (授業外学習(予習・復習)の指示)		Encourage volunteerism of every student Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)		Interfacial science, Chemisty, Chemical process, Chemical engineering. Electrochemmistry	
Required Textbooks(教科書)		Adviced in the Lecture	
References/Recommended Reading(参考書)		Not specify.	
Notes(備考)		This lecture will be given in Japanese. If some one who would like to study as for the ″Functional Intwerface Engineering″. The issue will be conducted through an individual consultation	
Email(電子メールアドレス)		haruyama@life.kyutech.ac.jp	

Course Name(科目名)	Bio functional molecular engineering		
Instructor Name(担当教員名)	Shinya Ikeno		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Biomolecules have an important role in the life activity of all living things on the earth. It can also be said it is a masterpiece of a molecule that is constructed by living things during the evolutionary process. This course deals with basis of biomolecular engineering using various types of bio functional molecules. It also enhances to introduce the application of the technology with new topics.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This exercises of "bioinformatics" is help to understand this course.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction	
	2.	Genetic information of cell (Basic)	Cell and its function
	3.	Bioinformatic molecules (1)	DNA
	4.	Bioinformatic molecules (2)	DNA and its sequseing technology
	5.	Bioinformatic molecules (3)	RNA and its technology
	6.	Amino acid, Peptide, and Protein (Basic)	Protein and its function
	7.	Biofunctional molecules (1)	Enzyme and its application
	8.	Biofunctional molecules (2)	Receptor and its application
	9.	Biofunctional molecules (3)	Antibody and its application
	10.	Bioaffinity	Analysis the interaction of bio functional molecules
	11.	Molecular recognition elements	Biofunctional molecules as a molecular recognition elements
	12.	Biosensor	Biosensor; analytical method by using bio functional molecules
	13.	Nanomaterials in biotechnology	Application of nanomaterials in biotechnology
	14.	Bio-nanotechnology	Biofunctional molecules with nanotechnology
	15.	Overview	Next-generation technology using biological functional molecules

General Course Policies(授業の進め方)	This course will be more or less demanding depending on the initial level in chemistry and biology.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	To understand biomolecules and it function in this course.
	Couse objectives (具体的な授業の達成目標)	1. To understand bioinformatics molecules and its function. 2. To understand biomolecules and its function. 3. To understand nano-biotechnology and its application.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class will be decided based on the following: Class attendance and mini-examination: 50% Term-end examination:50%	
Assignment Instructions (授業外学習(予習・復習)の指示)	We highly recommend you to prepare each lecture by reading the handout, and to review lecture for your understanding. Study 4 ours per week is required to prepare for the class.	
Keywords(キーワード)		
Required Textbooks(教科書)	No text book in this course. We provide the handout of each lecture.	
References/Recommended Reading(参考書)	Nothing special.	
Notes(備考)	This course will be taught in Japanese. But one of the course materials are in English. One English-speaking teaching assistant will be assigned to help non-Japanese students.	
Email(電子メールアドレス)	ikeno@life.kyutech.ac.jp	

Course Name（科目名）	Photo-functional materials		
Instructor Name(担当教員名）	Naoya MURAKAMI		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Description（授業の概要）	This course deals with the basic concepts and principles of photo-functional materials, such as semiconductor photocatalyst, from the viewpoints of photochemistry. It also introduces the basis of fundamental photochemistry and physical chemistry. The goals of this course are to obtain basic knowledge of principles and application of photo-functional materials.		
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）			

Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）
	1.	Introduction of Photo-functional materials	
	2.	Photocatalysis(1) Principle / water splitting	
	3.	Photocatalysis(2) Organic decomposition / visible light response	
	4.	Photocatalysis(3) Light-induced super-hydrophilicity / organic synthesis	
	5.	Photocatalysis(4) Photocatalyst-particles / Co-catalyst loading	
	6.	Photocatalysis(5) Physical and chemical propeties of particles	
	7.	Photocatalysis(6) Semiconductor films	
	8.	Photocatalysis(7) Semiconductor electrode 1	
	9.	Photocatalysis(8) Semiconductor electrode 2	
	10.	Solar cells (1) silicon	
	11.	Solar cells (2) inorganic	
	12.	Solar cells (3) organic	
	13.	Luminescent materials and device	
	14.	Photo-functional materials	
	15.	Optical parts and optical apparatus	

General Course Policies（授業の進め方）		This course will be taught in Japanese. But all of course materials are in English.
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	The aim of this course is to help students acquire knowledge of semiconductor materials and an understanding of basic principle of photocatalyst and solarcell.
	Couse objectives （具体的な授業の達成目標）	1. Students be able to explain structure and operating principle of semiconductor materials 2. Students be able to understand basic principle of photocatalysis 3. Students be able to understand basic principle of solar cell
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）		Your overall grade in the class will be decided based on the following: Class attendance and attitude(40%) and Reports(60%)
Assignment Instructions （授業外学習（予習・復習）の指示）		Students are expected to review after the lecture. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords（キーワード）		interaction of light and matter, electron energy structures of semiconductor materials, work function and junction, photon energy included in the sun, operating principle of solar cells, photocatalyst, photoelectrode
Required Textbooks（教科書）		Will be introduced in the class
References/Recommended Reading（参考書）		
Notes（備考）		This course will be taught in Japanese. But all of the course materials are in English.
Email（電子メールアドレス）		murakami@life.kyutech.ac.jp

Course Name(科目名)	Mechatronics			
Instructor Name(担当教員名)	Hideki HONDA			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	2
Course Description(授業の概要)	Aims of this course are to introduce a basic knowledge of Mechatronics and to practice some examples in order to use the knowledge in actual scene. In order to get higher machine performance, Mechatronics covers various aspects of the engineering – machine, electricity/electronics, computer and control –, but to grasp easily and conveniently, this lecture will be conducted according to processes of "Stabilization of inverted pendulum" and "Designing a automatic vending machine".			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course needs knowledge of mechanics and differential equations, which are basic subjects of general engineering departments. Although general knowledge of control engineering is used in this course, explanations will be given in this course, so it is not necessary to take a general course in control engineering in advance.			
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.	Introduction – Birth and history of Mechatronics		
	2.	Dynamics and Mechanics (How can we express a dynamics?)		
	3.	Acutators – Principle of motor		
	4.	Real-time control (1) ; Feedback control theory		
	5.	Real-time control (2) ; Feedforward control theory		
	6.	Real-time control (3) ; 2-degree of freedom control and Advanced control		
	7.	Design a control system-Feedback control; Inverted pendulum		
	8.	Sequence Control (1) ; Introduction		
	9.	Sequence Control (2) ; Components		
	10.	Sequence Control (3) ; Design logical circuits		
	11.	Sequence Control (4) ; Design tools		
	12.	Sequence Control (5) ; Design an automatic vending machine		
	13.	Conponents of Mechatronics system		
	14.	(The above schedule will be carried out in 15 classes.)		
	15.			
General Course Policies(授業の進め方)	This course uses PowerPoint, giving about 60 minutes of lecture and the remaining 30 minutes for execise.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	This course objective is to help students acquire the general knowledge for "moving an object as you wish using a motor".In particular, understanding the configuration outline of the mechatronics system using 1. Real-time control (feedback control / feedforward control)		
	Couse objectives (具体的な授業の達成目標)	1. Design a control system to stabilize the inverted pendulum 2. Design a sequence control flow for lunch-ticket vending machine 3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading will be decided based on total score of execises. [Remote Lecture ; Asynchronous style] For odd-numbered lectures (the first one will be on May 11th (Monday)), the materials (Document and Movies) will be released to you on Monday during AM, so please check the materials from the afternoon, and on the			
Assignment Instructions (授業外学習(予習・復習)の指示)	To prepare a distributed document that will be sent by e-mail before each class. Students are expected to set aside 4 hours a week as time for class preparation.			
Keywords(キーワード)				
Required Textbooks(教科書)	This course will be given using the distributed documents(written in both Japanese and English).			
References/Recommended Reading(参考書)	The references wii be specified in a timely manner.			
Notes(備考)	This course will be taught in Japanese. However the teacher will explain individually to those students who need explanation in English.			
Email(電子メールアドレス)	honda@life.kyutech.ac.jp			

Course Name(科目名)	Micro-Technology		
Instructor Name(担当教員名)	Iwao SASAKI		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	The aim of this course is to help students acquire Micro-Technology fabricated by deposition, removeing, modification and junction tecnologies. The goals of this course are to understand (1)The concept of Micro-Tecnology. (2)The applications, for example, mechatronics equipments, communication tools, eviromental frendly parts and so on. (3)Magnetism and magnetic materials by learning HDD and MRAM. (4)Measurement and analysis of micro fabrication.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Knowledge of physics and chemistry at the undergraduate general education level.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Guidance -Concept	
	2.	Significance of studying Micro-technology at LSSE	
	3.	Fundamentals of micro fabrications	
	4.	Example of parts and products	
	5.	Elementary technology for micro-technology	
	6.	Deposition	
	7.	Removing	
	8.	Modification	
	9.	Junction	
	10.	Actual fabrication for micro-technology	
	11.	Equipments	
	12.	Measurement and analysis of micro fabrications	
	13.	Fundamental of magnetism and magnetic material	
	14.	HDD (hard disk drive)	
	15.	MRAM (Magnetoresistive random-access memory)	

General Course Policies(授業の進め方)		Based on the lecture using PowerPoint, and students may also ask for a discussion.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	This course is classified as a specialized one. And cource objective are "Advanced expertise and understanding" and "Engineering, Technology, and Social Knowledge and Understanding" in "(1) Knowledge and understanding" of LSSE Curriculum Policy. Specific goals are as follows:
	Couse objectives (具体的な授業の達成目標)	1. To acquire knowledge so that they can conduct research and development activities by utilizing Micro- 2. To understand the role of Micro-technology in society. 3. To acquire knowledge about magnetic recording technology and understand the role they play in society.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Grading will be decided based on quizes and reports.
Assignment Instructions (授業外学習(予習・復習)の指示)		[prereration] The handout should be read deeply before attendance. Students are expected to set aside 4 hours a week as time for class preparation. [review] The handout should be understood after lecture.
Keywords(キーワード)		Microfabrication, Nanotechnology, Magnetic recording
Required Textbooks(教科書)		Handouts will be used.
References/Recommended Reading(参考書)		For example: Rainer Waser ed., "Nanoelectronics and Information Technology: Advanced Electronic Materials and Novel Devices, 3rd. ed." Wiley-VCH, 2012 [see Kitakyushu Science and Research Park Media Center]
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		sasaki@life.kyutech.ac.jp

Course Name(科目名)	Exercises on Measurement Control Systems		
Instructor Name(担当教員名)	Kazunori HASEGAWA, Shyam S. PANDEY		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	This cource aims to learn signal processing, measurement systems toward human-friendly control systems, and design and development novel organic semiconductors toward eco-friendly electronic devices. At first, it gives exercises in control of a digital circuit and a power electronic converter with a microcomputer. Then, it introduces molecular structure drawing and analysis.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Fundamentals and Overview of Microcomputers.	
2.	Control of LEDs with a Microcomputer	
3.	Control of a Power Electronic Converter	
4.	Control of a Power Electronic Converter (2)	
5.	Group Work with a Microcomputer (1)	
6.	Group Work with a Microcomputer (2)	
7.	Group Work with a Microcomputer (3)	
8.	Group Work with a Microcomputer (4)	
9.	Fundamentals and Overview Molecular Modeling	
10.	Introduction of Molecular Modeling Softwares and Molcrular Structure Analysis	
11.	Practice of Molecular structure drawing and Analysis with ChemDraw	
12.	Practice of Molecular Structure Analysis with Chem3D	
13.	Molecular Structure Analysis of Organic Semicondcutors	
14.	Introduction of Gaussian and Gauss View	
15.	Quantum Chemical calculations using Gaussian G16-I	
16.	Quantum Chemical calculations using Gaussian G16-II	

General Course Policies(授業の進め方)	Use the notebook computer lent by the department. Study materials will be suggested for prior study. Do not be absent without permission.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. To understand fundamentals of microcomputers. 2. To understand fundamentals of power electronic converter. 3. To understand fundamentals of molecular structure drawing and analysis.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Results of exercises and mini tests during the course.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Preperations of the flollowings are recommended: ・Fundamental knowledge of microcomputers. ・Fundamental knowledge of power electronics. ・Fundamental knowledge of chemical structure. ・Fundamental knowlede of physics and chemistry of semiconductors. Students are expected to set aside 1 hour a week as time for class preparation.	
Keywords(キーワード)	microcomputers, power electronics, molecular modeling	
Required Textbooks(教科書)	Commercially available textbooks are not used. Documents will be provided and referenceres will be introduced for each exercises.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)	hasegawa@life.kyutech.ac.jp; shyam@life.kyutech.ac.jp	

Course Name(科目名)	Introduction to AI and Robotics		
Instructor Name(担当教員名)	Keiichi HORIO, Takashi MORIE		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This special course is arranged for students of Car-Robo-AI Joint Graduate School. Ordinary students can take this course, but the lectures are mainly given in Japanese, and the support for international students will be minimum.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)		
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)			
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are expected to set aside 4 hours a week as time for class preparation.		
Keywords(キーワード)			
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)			
Email(電子メールアドレス)			

Course Name(科目名)	DEGEIKO Program 1, 2		
Instructor Name(担当教員名)	Professor in charge of DEGEIKO program		
Course intended for(対象学年)	1st or 2nd year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	These courses will accept master's students and aim at acquiring of knowledge and skills in areas different from special field of a student's home laboratory. The main content is introduction education to special field of an away laboratory whose guidance a student will receive. The away laboratories will provide so-called DEGEIKO packages that is a combination of lectures, reading of research papers, practice, and so on. Students should select and take courses from the DEGEIKO packages, taking into consideration their research and future career paths.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.		See the DEGEIKO program's guidance or ask your supervisor.
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)	Master's students can take DEGEIKO program 1 and 2 during different times and earn 2 credits in total.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading will be determined by efforts on classes, submission of assignments, reports, achievement of learning for the selected DEGEIKO package, etc. Students will be pass when they get a score greater than or equal to 3.5 in five grade evaluation. See the DEGEIKO program's guidance for more information.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Refer to the DEGEIKO program's guidance and investigate research topics of the away laboratory and what you do not understand before your DEGEIKO program.	
Keywords(キーワード)		
Required Textbooks(教科書)	Textbooks and References will be assigned by a supervisor of the away laboratory.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.	
Email(電子メールアドレス)		

Course Name(科目名)	DEGEIKO Program 3, 4			
Instructor Name(担当教員名)	Professor in charge of DEGEIKO program			
Course intended for(対象学年)	1st or 2nd year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	These courses will accept doctoral students and aim at acquiring of knowledge and skills in areas different from special field of a student's home laboratory. The main content is introduction education to special field of an away laboratory whose guidance a student will receive. The away laboratories will provide so-called DEGEIKO packages that is a combination of lectures, reading of research papers, practice, and so on. Students should select and take courses from the DEGEIKO packages, taking into consideration their research and future career paths.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)				
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.		See the DEGEIKO program's guidance or ask your supervisor.	
	2.			
	3.			
	4.			
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
General Course Policies(授業の進め方)	Doctoral students can take DEGEIKO program 1, 2, 3, and 4 during up to two different times through both our master program and doctoral program. Doctoral students can earn up to 4 credits in total.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)			
	Couse objectives (具体的な授業の達成目標)	1.		
		2.		
		3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading will be determined by efforts on classes, submission of assignments, reports, achievement of learning for the selected DEGEIKO package, etc. Students will be pass when they get a score greater than or equal to 3.5 in five grade evaluation. See the DEGEIKO program's guidance for more information.			
Assignment Instructions (授業外学習(予習・復習)の指示)	Refer to the DEGEIKO program's guidance and investigate research topics of the away laboratory and what you do not understand before your DEGEIKO program.			
Keywords(キーワード)				
Required Textbooks(教科書)	Textbooks and references will be assigned by a supervisor of the away laboratory.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.			
Email(電子メールアドレス)				

Course Name(科目名)	Interactive Seminar		
Instructor Name(担当教員名)	Professors/Associated Professors of Department of Human Intelligence Systems		
Course intended for(対象学年)	1st or 2nd year student		
Credit Category(単位区分)	Required course	Credits(単位数)	2
Course Description(授業の概要)	This course aims to train practical problem solving skills, presentation skills, and communication skills through mid-term presentation toward acquiring both the ability and expertise to logically analyze and solve problems for engineers, researchers, and entrepreneurs who practice brain-type information processing technology and its theory in various engineering fields and basic science fields. Furthermore, students will develop the motivation for research activities and improve the quality of research and master thesis through the mid-term presentation.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.		
	2.		
	3.		
	4.		1-8.
	5.		Mid-term presentation, Submission of a report on mid-term present
	6.		Attend to conference/meeting or lab seminar
	7.		
	8.		
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)	Students must conduct mid-term presentation, submission of a report on mid-term presentation, and atten to conference/meeting or lab seminar according to supervisors' guidance.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	(a) Mid-term presentation, (b) Submission of a report on med-term presentation, (c) Attend to conference/meeting or lab seminar	
Assignment Instructions (授業外学習(予習・復習)の指示)	Supervisors will instruct students to prepare and review.	
Keywords(キーワード)		
Required Textbooks(教科書)	Textbooks and references will be assigned by supervisors.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.	
Email(電子メールアドレス)		

Course Name(科目名)	Human Function Substitution System		
Instructor Name(担当教員名)	Chikamune Wada		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	The aim of this course will provide with the concept of substitution system for sensory system, motor system and internal organs. In this course, the knowledge about physiology and anatomy for human body will be instructed firstly, the deficiency of human ability/performance because of being disabled/illness will be provided secondly, and substitution system will be explained lastly. In this course, you can understand the mechanism for human body and .learn how to support human ability by using engineering technique.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course is the application in the field of researching devices with human friendly behaviour.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction and neural system	Outline of this course, neural system
	2.	Visual system	Mechanism of vision
	3.	Substitution for visuall system	Assistive device for vision
	4.	Auditory system and vocalization	Mechanism of hearing and vocalization
	5.	Substitution for auditory system and vocalization	Assistive device for hearing and vocalization
	6.	Motor system: Bone, muscle, upper limb, lower limb, trunk (1)	Mechanism of bone, muslce, limb and trunk
	7.	Motor system: Bone, muscle, upper limb, lower limb, trunk (2)	Mechanism of bone, muslce, limb and trunk
	8.	Substitution for motor system	Assitive device for motor function
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	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		Explaining mechanism and assistive device based on the distributed sildes
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	This course aims to provide the students with the knowledge about mechanism of sensory/motor function of human body and method to help the disabled/eldery, when designing a human-friendly system.
	Couse objectives (具体的な授業の達成目標)	1. Describe the structure of sensory and motor system. 2. Describe the mechanism to realize sensory and motor function. 3. Describe the assitive device and the unsolved problem.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Grading will be based on attendance and reports.
Assignment Instructions (授業外学習(予習・復習)の指示)		The students should download course materials in advance and read them. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		Assistive device, Physiology, Anatomy, Elderly, Disabled
Required Textbooks(教科書)		This course will not use a texbook. Course materials can be downloaed in advance.
References/Recommended Reading(参考書)		
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		wada@brain.kyutech.ac.jp

Course Name(科目名)	Intelligent integrated systems 1		
Instructor Name(担当教員名)	Takashi Morie		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	In order to realize human intelligence, systems mimicking human brain functions are being developed. Since information processing performed in the brain is highly nonlinear and in massively parallel, its implementation by serial digital computers is ineffective and it is difficult to compute it in practical time. Therefore, dedicated hardware to implement brain-like algorithms is required. The objective of this class is to learn the concepts and realizations of brain-like integrated circuits mainly by analog approaches.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	CMOS LSI and digital circuits	
	2.	Digital memory devices and circuits	
	3.	Analog memory devices and circuits	
	4.	Analog basic circuits for brain-like systems (1)	
	5.	Analog basic circuits for brain-like systems (2)	
	6.	Neural network LSI architecture	
	7.	Visual information processing using physical phenomena	
	8.	Pulse-based brain-like integrated circuits	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		Students are expected to have learned basics of electric circuits and neural networks. Students are also expected to have the class "Introduction to Computer Systems".
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. To understand the basics of CMOS integrated circuits 2. To understand the basics of analog circuits required for brain-like integrated circuits 3. To understand the basics of brain-like hardware architecture for intelligent processing
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Based on the results of mini-tests after classes, reports assigned several times, and the test at the last class.
Assignment Instructions (授業外学習(予習・復習)の指示)		Read lecture materials and references, and try to understand the contents of lectures before classes. Review the lessons after classes, and try to understand the contents of mini-tests completely. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		Neural network hardware
Required Textbooks(教科書)		Lecture materials are uploaded at "LiveCampus". References are announced at the first class.
References/Recommended Reading(参考書)		
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		morie@brain.kyutech.ac.jp

Course Name(科目名)	Intelligent Digital Integrated Circuits		
Instructor Name(担当教員名)	Hakaru Tamukoh		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	With the continuous progress of integrated circuit technology, in recent years, it has become possible to implement around 10 billion transistors in one chip. Digital hardware based on logic circuits realized by this integrated circuit technology is an extremely important device for supporting our advanced information society. This course will provide the latest topics related to integrated circuits and explain fundamental knowledge about embedded image processing by logic circuits. The aim of this course is to understand digital hardware architecture and its performance evaluation.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Embedded Real-time Image Processing	
	2.	Field Programmable Gate Array (FPGA)	
	3.	Design Process 1: Problem specification	
	4.	Design Process 2: Algorithm Development, Architecture Selection and System Implementation	
	5.	Mapping Techniques 1: Timing Constraints 1	
	6.	Mapping Techniques 2: Timing Constraints 2	
	7.	Mapping Techniques 3: Memory Bandwidth Constraints	
	8.	Mapping Techniques 4: Resource Constraints	
	9.		
	10.		
	11.		
	12.		
	13.		
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	15.		

General Course Policies(授業の進め方)	Students are expected to have learned basics of logic circuits, programming and computer systems.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Explain various architectures of digital circuits 2. Explain metrics of performance evaluation for digital circuits 3. Explain constraints of digital circuits design
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class is decided based on the followings: weekly report (50%) and term-end examination(50%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	Study the meaning of unknown technical term as preparation for the next lecture. After the class, list the keywords and investigate the research related to that keywords in books or search engine for academic texts. Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)		
Required Textbooks(教科書)	Donald G. Bailey, "Design for Embedded Image Processing on FPGAs", IEEE, John Wiley & Sons (Asia) Pte Ltd, 2011.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)		

Course Name（科目名）	Practicum in Intelligent Machine Design			
Instructor Name(担当教員名）	Chikamune WADA and Shinsuke Yasukawa			
Course intended for（対象学年）	1st year student			
Credit Category（単位区分）	Elective and required course		Credits（単位数）	1
Course Description（授業の概要）	In this practicum, students will learn basic signal processing method to develop intelligent machines or systems to realize human intelligence. To be specific, at first, students will learn measuring techniques for electromyogram through analog circuits, and also learn signal processing technique by LabVIEW. Next, students will learn signal processing and robot control method using Matlab/Simulink and Robot operating system(ROS).			
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	This course is aiming to learn measurement/control technique in the sensor-fusion and robotic research field.			
Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）	
	1.	LabVIEW (I/O) 1	Learning the usage of LabVIEW and peripheral devices	
	2.	LabVIEW (I/O) 2	Learning the usage of LabVIEW and peripheral devices	
	3.	LabVIEW (Motor control) 1	Learning the usage of LabVIEW and peripheral devices	
	4.	LabVIEW (Motor controld) 2	Learning the usage of LabVIEW and peripheral devices	
	5.	LabVIEW (Sensor measurement) 1	Learning the usage of LabVIEW and peripheral devices	
	6.	LabVIEW (Sensor measurement) 2	Learning the usage of LabVIEW and peripheral devices	
	7.	LabVIEW (Real tme processing) 1	Learning the usage of LabVIEW and peripheral devices	
	8.	LabVIEW (Real tme processing) 2	Learning the usage of LabVIEW and peripheral devices	
	9.	Matlab (signal processing) 1	Learning the usage of Matlab/Simulink and peripheral devices	
	10.	Matlab (signal processing) 2	Learning the usage of Matlab/Simulink and peripheral devices	
	11.	Simulink (control system design) 1	Learning the usage of Matlab/Simulink and peripheral devices	
	12.	Simulink (control system design) 2	Learning the usage of Matlab/Simulink and peripheral devices	
	13.	Robot control experiment 1	Learning the usage of Matlab/Simulink and peripheral devices	
	14.	Robot control expeirment 2	Learning the usage of Matlab/Simulink and peripheral devices	
	15.	Robot control experiment 3	Learning the usage of Matlab/Simulink and peripheral devices	
	16.	Robot control experiment 4	Learning the usage of Matlab/Simulink and peripheral devices	
General Course Policies（授業の進め方）	Students are asked to make algorithm and program by using LabVIEW and Matlab.			
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	By the end of the course, students should be able to do the following course objectives.:		
	Couse objectives （具体的な授業の達成目標）	1. Use LavVIEW to aid in the analysis and design of measurement/control systems. 2. Use Matlab to aid in the analysis and design of measurement/control systems. 3.		
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）	Evaluation will be done by attendance and achievement to the practice.			
Assignment Instructions （授業外学習（予習・復習）の指示）	Students will be expected to do practice for LabVIEW/Matlab. Students are expected to set aside 1 hours a week as time for class preparation.			
Keywords（キーワード）	LabVIEW, Matlab			
Required Textbooks（教科書）	Necessary material will be provided.			
References/Recommended Reading（参考書）				
Notes（備考）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.			
Email（電子メールアドレス）	wada@brain.kyutech.ac.jp, s-yasukawa@brain.kyutech.ac.jp			

Course Name(科目名)	Introduction to Computer Systems			
Instructor Name(担当教員名)	Hakaru Tamukoh, Takashi Morie			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	The objective of this course is to understand the fundamental concepts of computer systems that enable programs to execute on real hardware. The former part of this course provides the basics of the von Neumann architecture and digital hardware based on logic circuits. The latter part addresses the fundamental principles of MOS devices, with which current digital computers are constructed.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Students who plan to take the courses "Intelligent Digital Integrated Circuits", "Intelligent integrated systems 1 and 2" are recommended to take this course.			
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.	The von Neumann architecture		
	2.	Microprocessors and programming		
	3.	CPU, GPU, FPGA		
	4.	Logic circuits		
	5.	Fundamentals of semiconductors and p-n junctions		
	6.	Fundamentals of MOS devices		
	7.	Basic operation of MOS transistors		
	8.	Fundamentals of CMOS integrated circuits		
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
General Course Policies(授業の進め方)	Students are expected to have learned basics of electric circuits, logic circuits and computer systems.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)			
	Couse objectives (具体的な授業の達成目標)	At the end of the course, participants are expected to (1) Describe the basic operations of digital hardware (2) Describe the basic operations of CMOS devices		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Based on the results of mini-tests after classes and/or reports assigned several times.			
Assignment Instructions (授業外学習(予習・復習)の指示)	Read lecture materials and references, and try to understand the contents of lectures before classes. Review the lessons after classes, and try to understand the contents of mini-tests completely. Students are expected to set aside 2 hours a week as time for class preparation.			
Keywords(キーワード)				
Required Textbooks(教科書)	Lecture materials are uploaded at "Live Campus". References are announced in classes.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.			
Email(電子メールアドレス)	tamukoh@brain.kyutech.ac.jp, morie@brain.kyutech.ac.jp			

Course Name(科目名)	Robot Sensing		
Instructor Name(担当教員名)	Shinsuke YASUKAWA		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	The objective of this course is to understand sensing technology from the viewpoint of robot components. The former part of this course provides basics of sensors required for robots and their operating principles. The latter part explains the control method using sensor information, sensor fusion technology, and bio-inspired sensory system.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course is aiming to learn the theories and applications of measurement/control technique for robotics		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Sensing technology for field robotics	
	2.	Sensor and singal processing : basics	
	3.	Sensing for position or displacement	
	4.	Sensing for force or momentum	
	5.	Probability and statistics for sensing : basics 1	
	6.	Probability and statistics for sensing : basics 2	
	7.	Probability and statistics for sensing : advance 1	
	8.	Probability and statistics for sensing : advance 2	
	9.	Sensor control 1 (position/speed)	
	10.	Sensor control 2 (force/impedance)	
	11.	Sensor fusion 1 (self localization)	
	12.	Sensor fusion 2 (SLAM)	
	13.	bio-inspired sensory system : basics	
	14.	bio-inspired sensory system : advance	
	15.	Summary	
	16.		

General Course Policies(授業の進め方)		
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	learn the sensor and its applied technology knowledge, and have the knowledge to select sensors according to robot applications
	Couse objectives (具体的な授業の達成目標)	1. Understand the sensor operating principle 2. Understand control technology using information from sensors 3. Have the knowlegdes to select sensors according to robotics applications
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Based on the results of report after classes	
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are expected to review the basics of mathematics (mainly linear algebra and calculus) Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)	Instrument and Control, Robotics, Robot vision	
Required Textbooks(教科書)	Necessary material will be provided.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)	s-yasukawa@brain.kyutech.ac.jp	

Course Name(科目名)	Fandamental Machine Learning 2A		
Instructor Name(担当教員名)	Keiichi Horio		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	For machine learning, we introduce regression and classification, which are frameworks of supervised learning. The purpose of this study is to understand the basics of Least Square Method and its problems, and to learn practically applicable knowledge and techniques through learning various improvement methods such as constraints.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	It is also desirable to take Basic Mathematics A.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Machine Learning, and Learning Models	
	2.	Least Squares Learning	
	3.	Constrained Least Squares Learning	
	4.	Sparse Learning	
	5.	Classification based on Least Squares Learning	
	6.	Support Vector Machines	
	7.	Ensemble Learning	
	8.	Summary	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)	lectures are based on using PowerPoint. In addition, I introduce program sources as appropriate and promote their use in actual problems.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goal is to be able to understand and use regression and classification problem setting, least squares method and various improvement methods. The following are the goals.
	Couse objectives (具体的な授業の達成目標)	1. Understand the characteristics and differences of various models in regression and classification. 2. Understand the concept of least-squares method and implement programs. 3. Understand the problems of the least squares method and various improvement methods, and
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading is assessed on a small assignment (50%) and a final report (50%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	Make a brief survey on the next theme. As a preparatory study, prepare 2 hours a week. Students are expected to set aside 2 hours a week as time for class preparation.	
Keywords(キーワード)	Regression, Classification, Least squares method, Constrained least squares, Objective function	
Required Textbooks(教科書)	Materials are introduced in the classes.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)	horio@brain.kyutech.ac.jp	

Course Name(科目名)	Fandamental Machine Learning 2B			
Instructor Name(担当教員名)	Keiichi Horio			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	Dimension reduction and clustering, which are unsupervised learning are introduced. Furthermore semi-supervised learning, transfer learning, and multitasking learning are also introduced as advanced topics while intermingling the latest topics on artificial intelligence.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	It is also desirable to take Basic Mathematics A.			
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.	Abnormality Detection		
	2.	Unsupervised Dimensionality Reduction		
	3.	Clustering		
	4.	Online Learning		
	5.	Semi-superbised Learning		
	6.	Supervised Dimensionality Reduction		
	7.	Transfer Learning, Multi-task Learning		
	8.	Summary		
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
General Course Policies(授業の進め方)	lectures are based on using PowerPoint. In addition, I introduce program sources as appropriate and promote their use in actual problems.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The purpose of this study is to understand the problems and solutions of unsupervised learning and advanced topics applied to various data in real problems. The following are the goals.		
	Couse objectives (具体的な授業の達成目標)	1. Understand dimension reduction and clustering, which are typical unsupervised learning problems.		
		2. Understand the difficulties of handling real data, and understand and utilize methods to solve them.		
		3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading is assessed on a small assignment (50%) and a final report (50%).			
Assignment Instructions (授業外学習(予習・復習)の指示)	Make a brief survey on the next theme. As a preparatory study, prepare 2 hours a week. Students are expected to set aside 2 hours a week as time for class preparation.			
Keywords(キーワード)	Unsupervised Learning, Online Learning, Transfer Learning			
Required Textbooks(教科書)	Materials are introduced in the classes.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.			
Email(電子メールアドレス)	horio@brain.kyutech.ac.jp			

Course Name(科目名)	Brain-Inspired Learning Theory A		
Instructor Name(担当教員名)	Tomohiro Shibata		
Course intended for(対象学年)	1st or 2nd year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	Lecture on model of neural network (neural network) which is brain type learning theory and learning theory. First, you study basic mathematical models and theories such as Perceptron, Self-Organizing Map, Hopfield Network, Boltzmann Machine, followed by the state-of-the-art models and theories of deep neural networks.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Taking the following classes is desirable: Fundamentals of Mathematics A, Fundamental Machine Learning 2A & 2B.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction	
	2.	Computational Theories of the Brain	
	3.	Perceptrons	
	4.	Self-Organization Maps	
	5.	Hopfield Networks	
	6.	Boltzmann Machines	
	7.	Deep Neural Networks	
	8.	Summary	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		Slides using PowerPoint will be mainly used in the lecture. Mini-tests, mini-reports, and programmin excercies will be used to know how well the students understand the lecture.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Excellent or A (passed) 90 to 100 points The target has been sufficiently achieved, and is extremely 2. Excellent or B (pass) 80 to 89 points The target has been sufficiently achieved. 3. Good or C (pass) 70 to 79 points The target has been achieved.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Evaluation is conducted together with reports, tasks imposed during class and final exams.
Assignment Instructions (授業外学習(予習・復習)の指示)		Hanouts must be downloaded and read in advance. Also, a report should be submitted for the tasks indicated during the class period. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		Computational Neuroscience, Perceptrons, Self-Organization Maps, Hopfield Networks, Boltzman Machines, Deep Neural Networks
Required Textbooks(教科書)		There is no particular textbook.
References/Recommended Reading(参考書)		The reference book is as follows. (1) Haykin:Neural Networks, Prentice Hall, 1999 (2) Goodfellow, et al.:Deep Learning, The MIT Press, 2016.
Notes(備考)		Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.
Email(電子メールアドレス)		tom@brain.kyutech.ac.jp

Course Name(科目名)	Brain-Inspired Learning Theory B		
Instructor Name(担当教員名)	Takayuki OSA		
Course intended for(対象学年)	1st or 2nd year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	Lecture on reinforcement learning theory field which is a big field of brain type learning theory. First, we begin with fundamental multiband Bandit problem and then introduce Markov decision process. Subsequently, we look at the policy gradient method, which is the core of reinforcement learning. In the second half, we briefly go through the frontiers of reinforcement learning.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)

	Theme(テーマ)	Contents(内容)
1.	Introduction	The overview of the field of reinforcement learning will be explained.
2.	Multiarm Bandit Problem	As a preparation to learn reinforcement learning algorithms, we will f
3.	Markov Decision Process	We will look at the Markov Decision Process (MDP), which is the bas
4.	Bellman equation, (Deep) Q-learning	We will learn the Bellman equations, which the value functions satisf
5.	Policy Gradient	We will learn the policy gradient, which is a core algorithm for trainin
6.	Actor critic methods, natural gradient	We will learn Actor Critic methods and the natural policy gradient m
7.	Inverse Reinforcement Learning	We will learn the inverse reinforcement learning (IRL), which estimat
8.	Frontiers of RL & Summary	The state-of-the-art methods of RL will be explained.
9.		
10.		
11.		
12.		
13.		
14.		
15.		

General Course Policies(授業の進め方)	Class Mathematics Foundation is essential.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goal of this course is to understand the basics of reinforcement learning.
	Couse objectives (具体的な授業の達成目標)	1. understand the category of reinforcement learning and their applicability 2. understand the basics of reinforcement learning theory 3. understand how to implement the reinforcement learning methods
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grades are determined by the quiz, report and final exam,	
Assignment Instructions (授業外学習(予習・復習)の指示)	Hanouts must be downloaded and read in advance. Also, a report should be submitted by the due date indicated during the lectures. Students are expected to set aside 2 hours a week as time for class preparation.	
Keywords(キーワード)	Reinforcement learning, Markov decision process, Policy gradient	
Required Textbooks(教科書)	There is no particular textbook.	
References/Recommended Reading(参考書)	(1)Sutton&Barto:Reinforcement Learning, The MIT Press, 1998 (2)Szepesvari:Algorithms for Reinforcement Learning, Morgan&Claypool Publishers, 2010 (3)Goodfellow, et al:Deep Learning, The MIT Press, 2016	
Notes(備考)	Usually lectures are given in Japanese. However some parts are explained in English if necessary. Most of slides are written in English.	
Email(電子メールアドレス)		

Course Name(科目名)	Brain Inspired Information Processing A			
Instructor Name(担当教員名)	Kaori Yoshida			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	Visual Information System is an information processing system which enables to understand meaning or contents of images such as pattern information. In addition, it is one of the important research areas of higher brain functions. This course aims to improve students understanding of fundamental visual information processing technologies and its applications. Course objectives are (1) to understand fundamental visual information processing technologies, (2) to diagnose how visual systems work, (3) to apply visual information processing technologies to real-world tasks. After completing this course students will be able (1) to demonstrate an understanding of fundamental visual information processing technologies, (2) to describe how visual systems work subjectively, (3) to explore advanced visual information processing technologies.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)				
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.	Fundamentals of Visual Information Processing (1)		
	2.	Fundamentals of Visual Information Processing (2)		
	3.	Color Systems		
	4.	Color Image Processing (1)		
	5.	Color Image Processing (2)		
	6.	Subjective Visual Information Processing (1)		
	7.	Subjective Visual Information Processing (2)		
	8.	Advanced Visual Information Processing		
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
General Course Policies(授業の進め方)	This course is not recommended for students who have mastered basic image processing technologies. Students should take the course of Fundamentals of Mathematics.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	Course objectives are (1) to understand fundamental visual information processing technologies, (2) to diagnose how visual systems work, (3) to apply visual information processing technologies to real-world tasks.		
	Couse objectives (具体的な授業の達成目標)	1. to demonstrate an understanding of fundamental visual information processing technologies 2. to describe how visual systems work subjectively 3. to explore advanced visual information processing technologies		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Evaluation will be given by tasks assigned to each topic. Task assignments 100%. Students need to earn at least 60 points to get the credits.			
Assignment Instructions (授業外学習(予習・復習)の指示)	Download handouts in advance and read them before attending. Students are expected to set aside 2 hours a week as time for class preparation.			
Keywords(キーワード)				
Required Textbooks(教科書)	No textbooks required. References will be introduced in the lecture if necessary. Lecture handouts are distributed through LiveCampus.			
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in English. However we will have lecture in Japanese if there are students who need explanation in Japanese			
Email(電子メールアドレス)				

Course Name(科目名)	Fundamentals of Mathematics A		
Instructor Name(担当教員名)	FURUKAWA		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Linear algebra is an indispensable foundation in the fields of information science and system engineering, such as artificial intelligence, machine learning, robotics, and so on. This course deals with the basic concepts and principles of linear algebra as a fundation of engineering. There are two main aims of this course; one is to review the elementary knowledge learnt in undergraduate, and the other is to introduce some advanced concepts as well as some applied fields. The purpose is to acquire the knowledge and skills of linear algebra necessary for research and learning in the above fields.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This course provides the funations of other courses related to machine learning, artificial intelligence, statistics, signal processing, and robotics. Especially the students who take the courses on machine learning are strongly encouraged to take this course.		
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Numerical vectors	Numerical vector space and their operations.
	2.	Vector spaces	Linear space, linearly independence, basis vectors.
	3.	Matrix and linear mapping	Matrices and their operations, linear mapping
	4.	Linear system and solution space	Solving methods of linear systems and solution space.
	5.	Determinant	Calculation of determinants and its applications.
	6.	Eignevalue and eigenvector	Concept of eigenvalue and eigenvectors, calculation method.
	7.	Applications of eigenvalue	Application of eigenvalues to sequences, differential equations, etc.
	8.	Abstract vector space	Abstract definition of vector and vector spaces, substance and representation.
	9.	Inner product and norm	Inner product, norm, complex vectors, Hilbert space
	10.	Orthogonal matrix and orthonormal system	Orthogonal matrices and their properties, Hermitian matrices, orthonormal expansions.
	11.	Differentiation of vectors and matrie	Differentiation of scalars by vectors and matrices, differentiions matrices by scalars
	12.	Quadratic form and optimization problems	Quadratic form, positive-definite symmetric matrices, quadratic optimization problems.
	13.	Rectangular matrices and generalized inverse	Generalized inverse and its applications.
	14.	Matrix decompositions	Singular value decompositions, principal component analysis
	15.	Final examination	
General Course Policies(授業の進め方)	This course is mainly conducted with lectures using slides. Students are expected to download materials in advance and prepare for the class. Also, exercises will be given during the lecture and submitted to the next class as a weekly report. Use the Live Campus System to download materials and submit reports.		
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goals of this course are as follows. The first is to understand basic concepts acculately such as linear independence, linear mapping, determinants, and eigenvalues, and to acquire skills that can be applied in actual research. The second is to acquire more advanced and practical knowledge and skills such as matrix differentiation, general reversible matrix, and matrix decomposition. The third is to obtain the mathematical understanding that underlies these concepts.	
	Couse objectives (具体的な授業の達成目標)	1. Be able to explain the basic concepts such as linear space, linear mapping, and eigenvalues, and deal with them. Be able to toolve basic problems such as linear systems and eigenvalue problems. 2. Be able to explain the principles of the advanced methods such as generalized inverse and matrix decompositions. Be able to solve applied problems such as optimization problems. 3. Be able to explain the abstract concepts related to linear space and linear mapping.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class is decided based on the followings: Final examination (50%) and weekly reports (50%).		
Assignment Instructions (授業外学習(予習・復習)の指示)	Preparation: Download the materials in advance, and prepare the class. Students are expected to set aside 4 hours a week as time for class preparation. Review: Some questions are indicated in the class. Solve them and submit the answers as weekly reports.		
Keywords(キーワード)	No specific textbook is used in this lecture.		
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)	This course is designed for graduate students who have already acquired the elementary skills of linear algebra. It is desirable that students brushup on the elementary knowldege before taking this class.		
Email(電子メールアドレス)	furukawa@brain.kyutech.ac.jp		

Course Name（科目名）	Information Processing using Brain Dynamical System		
Instructor Name(担当教員名）	Kiyohisa Natsume		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Description（授業の概要）	In the class, I pick up the topic on the local neuronal network related to memory, motor control, and neuronal oscillation, and also pick up the topic on the Brain Machine Interface. In the first two classes, I review the basic knowledge of the neuroscience.		
Course and Curriculum linkage （カリキュラムにおけるこの授業の位置付け）	Please take the class "Basic Neuroscience" in 1Q.		

Course Calendar/Class Topic （授業計画）		
	Theme(テーマ)	Contents（内容）
1.	The Basics of Neuroscience ～Molecular biology～	
2.	The Basics of Neuroscience ～Neurophysiology～	
3.	Basic Neuronal Circuit I ～From formal neuron to computer	
4.	Basic Neuronal Circuit II ～From formal neuron to computer	
5.	Neuronal rhythm network ～Central Pattern Generator (CPG)	
6.	Reflexion I ～Basic Reflexion Circuit～	
7.	Reflexion II ～The control of the reflexion by the brain～	
8.	Rhythmic Neuronal Circuit for the Locomotion	
9.	Basal Ganglia for Motor Control	
10.	Neuromodulation networkI ～Cholinergic Circuit for Sleep and wake cycle～	
11.	Neuromodulation networkII ～Adrenergic Circuit for Sleep and wake cycle～	
12.	Neuromodulation networkIII ～Dopaminergic Circuit for Reinforce learning～	
13.	Neuromodulation networkIV ～Serotonergic and Oxytocin Circuit for Social Behavior～	
14.	The neuronal network relating to the memory ～The corttical, and hippocampal circuit～	
15.	Brain machine interface ～The controls of the machine using brain signals～	

General Course Policies（授業の進め方）		Download the class materials in Moodle. You should submit the reports via Moodle.
Course Objectives （授業の達成目標）	Introduction to Couse Objectives （授業の達成目標の解説）	
	Couse objectives （具体的な授業の達成目標）	1. Understanding the mechanism for the generation of Neuronal Rhythm 2. Understanding the mechanism for the generation of CPG 3. Proposing a Future technology related to the Brain Information Technology
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）		There are no exams, but students are required to write reports. The final score will be calculated based on the following points; Assessment of performance score of 32%, and Reports score of 68%.
Assignment Instructions （授業外学習（予習・復習）の指示）		To prepare for the next class, please look up the meaning for unknown words. Students are expected to review what you learned in the class, and utilize that for the report. Students are expected to set aside 4 hours a week as time for class preparation.
Keywords（キーワード）		Neuron, EEG, CPG, Synchrony, BCI
Required Textbooks（教科書）		M.F. Bear et al., "Neuroscience: Exploring the Brain, 4th Edition", Lippincott Williams and Wilkins; 4th edition (2015) D. Purves et al. "Neuroscience, Fifth Edition", Sinauer Associates, Inc. (2011)
References/Recommended Reading（参考書）		
Notes（備考）		Usually lectures are given in Japanese. However we will have lecture in English on a different day if there are students who need explanation in English.
Email（電子メールアドレス）		natume@brain.kyutech.ac.jp

Course Name(科目名)	Mathematical Neurophysiology A		
Instructor Name(担当教員名)	Katsumi Tateno		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This course, which is designed to introduce graduate students to mathematical neurophysiology, is targeted to a variety of students with diverse backgrounds and various experiences with biological study. The course introduces mathematical models of a neuon. Based on nonlinear analysis, neuronal excitability will be lectured. Several simplified neural cell models will be introduced as examples.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction of nonlinear dynamics: Phase plane, trajectory, fixed point	
	2.	Introduction of nonlinear dynamics: Local stability analysis	
	3.	Introduction of nonlinear dynamics: Bifurcation theory	
	4.	One-dimensional spiking neuron model	
	5.	Two-dimensional spiking neuron model 1	
	6.	Two-dimensional spiking neuron model 2	
	7.	Bursting electrical activity – Simplified model	
	8.	Final exam	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		Students are expected to earn a credit for "Basic Neuroscience".
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goal of this lecture is to learn simplified mathematical models of neurons and their stability analysis as the basis of neuroscience.
	Couse objectives (具体的な授業の達成目標)	1. In this lecture, students will gain knowledge about simplified neuron models, 2. stability analysis of neuron models, 3. bufurcation of neural excitability.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Your overall grade in the class will be determined based on the following: – Quizzes: 30% – Final exam: 70%
Assignment Instructions (授業外学習(予習・復習)の指示)		We highly recommend preparation for each lecture by reading the corresponding chapters in the books provided for reference. Computational models introduced in the class are found on Moodle. Please use those computational models for your revisions.Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		spiking neuron models; stability analysis; bifurcation
Required Textbooks(教科書)		Lecture materials will be published in Kyutech Moodle.
References/Recommended Reading(参考書)		1. Dynamical Systems in Neuroscience, Izhikevich, MIT Press, 2007 2. Understanding Nonlinear Dynamics, D. Kaplan, L. Glass, Springer, 1995 3.「神経システムの非線形現象」, 林初男, コロナ社
Notes(備考)		This course will be taught in Japanese. However, all course materials are in English.
Email(電子メールアドレス)		tateno@brain.kyutech.ac.jp

Course Name(科目名)	Mathematical Neurophysiology B		
Instructor Name(担当教員名)	Katsumi Tateno		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This course, which is designed to introduce graduate students to mathematical neurophysiology, is targeted to a variety of students with diverse backgrounds and various experiences with biological study. The course introduces a mathematical approach to neurophysiology. Mathematical and physical laws that constitute the basis of cellular neurophysiology will be addressed. Procedures for computer simulation of a neuron model will be included.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Ion channel	
	2.	Hodgkin-Huxley model	
	3.	Calcium dynamics	
	4.	Bursting electrical activity - Conductance-based model	
	5.	Periodic neural activity	
	6.	Chaotic neural activity	
	7.	Synchronization	
	8.	Final exam	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		Students are expected to earn a credit for "Basic Neuroscience".
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goal of lecture is to learn mathematical models of neurons based on electrophysiological results, and nonlinear dynamics of neurons, such as chaos and synchronization, as the basis of neuroscience.
	Couse objectives (具体的な授業の達成目標)	1. In this lecture, students will gain knowledge about Hodgkin-Huxley model, 2. chaotic responses of neurons, 3. synchronization of neural excitation.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Your overall grade in the class will be determined based on the following: - Quizzes: 30% - Final exam: 70%
Assignment Instructions (授業外学習(予習・復習)の指示)		We highly recommend preparation for each lecture by reading the corresponding chapters in the books provided for reference. Computational models introduced in the class are found on Moodle. Please use those computational models for your revisions. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		Hodgkin-Huxley model, chaos, synchronization, phase response curve
Required Textbooks(教科書)		Lecture materials will be published in Kyutech Moodle.
References/Recommended Reading(参考書)		1. Dynamical Systems in Neuroscience, Izhikevich, MIT Press, 2007 2. Mathematical Physiology I: Cellular Physiology, J. Keener, J. Sneyd, Springer, 2009 3.「神経システムの非線形現象」, 林初男, コロナ社
Notes(備考)		This course will be taught in Japanese. However, all course materials are in English.
Email(電子メールアドレス)		tateno@brain.kyutech.ac.jp

Course Name(科目名)	Molecular sensing systems		
Instructor Name(担当教員名)	Yoshitaka OHTUBO		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Higher organisms, including humans, have developed sensing systems such as vision and taste for detection of objects and phenomena in their environments. This course introduces how they convert physical and chemical stimuli involved in the outside world into biological information, and how they transmit that information from peripheral sensing organs to the central nervous system at molecular and cellular levels. In addition, methods of investigating molecules and cells and principles of electrophysiological and optical measurements will be introduced.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	eukaryotic cell structure	
	2.	nucleic acids, proteins, and lipids	
	3.	cell cycle and programmed cell death	
	4.	reverse transcription polymerase chain reaction (RT-PCR) technique	
	5.	immunohistostaining and confocal microscopy	
	6.	electrophysiological recording (patch-clamping) and Ca imaging	
	7.	diffusion potential, ion channels, and membrane potential	
	8.	excitability and receptors	
	9.	cell communication (synapses and paracrine)	
	10.	signal transduction in the retina	
	11.	signal transduction of pain and temperature	
	12.	signal transduction of mechanoreceptor cells and hair cells	
	13.	signal transduction of olfactory cells	
	14.	structures of taste buds and their postnatal development	
	15.	signal transduction of taste bud cells and modulation of taste information	

General Course Policies(授業の進め方)		Admission to this course will be recommended after taking Basic Neuroscience	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	the goals of this course are 1) to understand the signal transduction mechanisms within sensory organs 2) to learn how to measure the electrical and Ca2+ signals from living cells and how to investigate the	
	Couse objectives (具体的な授業の達成目標)	1. to be explainable for DNA to protein translation and membrane potential changes of excitable cells 2. to be explainable for the signal transduction mechanisms via G-proteins in sensory organs 3. to be explainable for measuring principles of RT-PCR, immunohistostaining, patch clamp recording, and	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Your final grade will be calculated according to the following process: attitude in class, short test for each topic, and end-of-term examination.	
Assignment Instructions (授業外学習(予習・復習)の指示)		Students are expected to conduct a preliminary investigation of the topics presented above before each topic is studied in class.	
Keywords(キーワード)		electrophysiology, molecular biology, sensory organs, chemical senses, intracellular signal transducion	
Required Textbooks(教科書)		Materials for the lecture will be distributed to students at each lecture.	
References/Recommended Reading(参考書)		Ion channels of excitable membranes 3nd edition, Molecular biology of the cell, Principles of neuroral science	
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)			

Course Name(科目名)	Team Management		
Instructor Name(担当教員名)	Doosub Jahng, Ph.D.		
Course intended for(対象学年)	1st , 2nd or 3rd year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	Department of Human Intelligence Systems Team Management, TM_2017 (2.0 units; Elective Course/Senmon Kamoku) Instructor: Doosub Jahng, Ph.D. Lecture: Thurs 8:50-12:00 (90 min x 16 = 24 hrs.), 2nd Q Location: Room 7510 Course Description: This course will focus on the use of the interface concept when approaching the challenges of team management. Students will be exposed to basic research methods and gain insight into the scientific processes involved in carrying out a research project.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Soft-skills for team activities in vairous situations		
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Learning Tools Guidance	KWM (Key Words Meeting ®), Table Whiteboard, Multiscreen, and KW
	2.	General Guidance	Self-introduction, Study groups setting, Group Introduction
	3.	System and Management	Difference, PDCA Cycle
	4.	Hierarchy of Organizational Communication	Intra- and Inter-, SWOT Analysis
	5.	Team Communication Interface	proposal style of "Casting, Stairs, and Abstracts"
	6.	8w3h1s	advanced 5w1h format
	7.	WESKT Presentation Preparation Methods	
	8.	Information Relay Model	
	9.	70% Scheduling	self development strategy
	10.	Evaluation and Estimation	differences and rules
	11.	Administrator, Leader, and Manager	differences and roles
	12.	Communication: Theory and Model	
	13.	Marketing: Concepts and Survey of Needs	needs, wants, products, 4Cs
	14	Diversity and Multi-facets	
	15	Course Reflection	
	16	Career Path	
General Course Policies(授業の進め方)	Remarks on Attendance: Students who fail to attend the first day of class without prior notice will be dropped from the course. For maximum efficiency, course enrollment will be limited to 25 seats. Special exceptions will be given to highly motivated students who wish to take the course.		
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	Students will develop critical thinking skills needed to analyze the research questions and will learn how to work as a team.	
	Couse objectives (具体的な授業の達成目標)	1. Discuss the historical significance and growing importance of soft skills. 2. Understand the organizational communication hierarchy and related models/ theories. 3. Develop skills needed for team communication including visualization of evaluation, mission setting and	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grading Outline: Learning activity, After-class submission, Review of feedback, and In-class participation. Student Assessment: Grading Outline breakdown will be discussed and adjusted throughout the course. Students will be given the opportunities to negotiate with the professor and will be encouraged to use their negotiating skills and learn how to mold consensus when discussing the percentage breakdown. Class grading will involve interactive communication for a two-way learning experience.		
Assignment Instructions (授業外学習(予習・復習)の指示)	Extensive before-class preparation, in-class participation and reflection of feedbacks will be crucial to ensuring the class' success. Students will be expected to consistently submit their reports and review professors' feedbacks on KWM before attending the next lecture. Students who don't wish to use KWM will be required to submit written learning reports. (Come talk to me separately for further information.) Students are expected to set aside 4 hours a week as time for class preparation.		
Keywords(キーワード)	soft skill, system and management, communication		
Required Textbooks(教科書)			
References/Recommended Reading(参考書)	Doosub Jahng, Three Fundamentals of Efficient Worklife in Team, JISHA, 2003 (Japanese)		
Notes(備考)	English, Japanese, or a combination of the two will be used throughout the course. The students' overall language abilities will be taken into account during lectures and discussions. One exception to this policy is KWM feedback, which will be solely given in Japanese. When using Table Whiteboard during team discussion, students will be asked to write Furigana when using Kanji. International students are highly encouraged to bring Japanese/English dictionary and are welcome to write in English on whiteboards. It is hoped that these measures will facilitate mutual learning process between international students and their fellow, native colleagues.		
Email(電子メールアドレス)	jahng@brain.kyutech.ac.jp		

Course Name(科目名)	Practicum in Neural Information Processing		
Instructor Name(担当教員名)	Katsumi Tateno, Yoshitaka Otsubo		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective and required course	Credits(単位数)	2
Course Description(授業の概要)	This course has been designed to provide first year master s or doctor s students with the data analysis techniques and the computational techniques necessary to deal with brain science and to understand the applications of brain science. This course is to help to understand the human intellectual intelligence and to develop the systems inspired by the brain functions. Students learn the principle for the action of neurons. The work of the course is done via a series of exercises. The practicum consists of two parts. In the first part, you can learn the electrical induction mechanism of neurons by the practicum using electrical equivalent circuit and the experimental data, and the imaging technique for proteins involved in signal transduction of neurons. The second part of the practicum introduces three computational models of a neuron and the phase plane analysis of neural dynamics. We also introduce relevant MATLAB functions that allow you to create a computational neuron model.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
		[Part1]	
	1.	Introduction to Part 1 (diffusion potential, ion channels, action potential) (90min x 2)	
	2.	pCLAMP tutorial and equivalent circuit of cells (90min x 2)	
	3.	Voltage dependence of K channel (90min x 2)	
	4.	Voltage dependence of Na channel (90min x 2)	
	5.	Immunostaining (primary antibody) (90min x 2)	
	6.	Immunostaining (secondary antibody) (90min x 2)	
	7.	Immunostaining (imaging) (90min x 2)	
	8.	Instructor feedback (90min x 1)	
		[Part 2]	
	9.	Introduction to Part 2, and MATLAB tutorial (90min x 2)	
	10.	FitzHugh-Nagumo model (90min x 2)	
	11.	Phase plane analysis (90min x 2)	
	12.	Spiking neuron model (90min x 2)	
	13.	Hodgkin-Huxley model (90min x 2)	
	14.	Action potential propagation in an excitable sheet (90min x 2)	
	15.	Bursting electrical activity (90min x 2)	
	16.	Instructor feedback (90min x 1)	

General Course Policies(授業の進め方)		To have this class, you should take classes, Basic Neuroscience.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The goals of this course are 1. To acquire an analysis of voltage-gated currents on excitable cells 2. To acquire mathematical models of neurons necessary for neuroscience
	Couse objectives (具体的な授業の達成目標)	1. Students should be able to do the following: To learn how to analyze the ion channel properties and how 2. Use MATLAB to build and use mathematical neuron models, 3. To learn how to write an experimental report.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		There are no exams, but students are required to write reports. Part 1 (50 %) and Part 2 (50 %).
Assignment Instructions (授業外学習(予習・復習)の指示)		To prepare for the next class, please look up the meaning for unknown words. Students are expected to review what you learned in the practicum, and utilize that for the report. [Part2] We highly recommend to prepare each lecture by reading the Exercise section of the corresponding chapter in the textbook. Students are expected to set aside 1 hour a week as time for class preparation.
Keywords(キーワード)		voltage-gated currents; immunohistostaining; MATLAB; spiking neuron models; stability analysis
Required Textbooks(教科書)		[Part1] Explanatory material of the neural activity recorded data is distributed. You don't use a textbook. [Part2] An textbook will be distributed in the class.
References/Recommended Reading(参考書)		[Part1] Ion channels of excitable membranes, 3nd edition, Berttil Hille, Sinauer Associates, Inc. (2001)
Notes(備考)		Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.
Email(電子メールアドレス)		otsubo@brain.kyutech.ac.jp; tateno@brain.kyutech.ac.jp

Course Name(科目名)	Basic Neuroscience		
Instructor Name(担当教員名)	Kiyohisa NATSUME		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Description(授業の概要)	The aim of this course is to understand the basic brain structure and function. Basic property of neuron and grial cells, hierarchical structue and function of the brain are discussed.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	In the class, the basic knowledge on neurons and brains is given. The knowledge is necessary to learn animal and human behaviors in neuroscience field and neural networks in engineering filed.		

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Structure of biological systems: cell, tissure, organ	Introduce the Structure of biological systems: cell, tissure, organ
2.	Evolution and development of biological systems and nervous	Introduce Evolution and development of biological systems and nervous sytem
3.	Cellular basis of neurons and glial cells	Introduce Cellular basis of neurons and glial cells
4.	Equilibrium potential	Introduce Equilibrium potential
5.	Action potential	Introduce Action potential
6.	Neural circuits and neurotransmitters	Introduce Neural circuits and neurotransmitters
7.	Vision Sensing	Introduce Vision Sensing
8.	Auditory Sensing	Introduce Auditory Sensing
9.	Spinal cord: Reflex	Introducede Spinal cord: Reflex
10.	Celebellum: Motr control and skill learning	Introduce Celebellum which relates to Motr control and skill learning
11.	Thalamus: Cortico-subcortical relay of sensory and motor signals	Introduce Thalamus which is cortico-subcortical relay of sensory and motor signals
12.	Basal ganglia: Involuntary movements and reward	Introducee Basal ganglia which relates to Involuntary movements and reward
13.	Limbic system: Emotion, learning and memory	Introduce Limbic system which relates to Emotion, learning and memory
14.	Cerebral cortices: sensory perception and voluntary movements	Introduce Cerebral cortices which relates to sensory perception and voluntary movements to memory.
15.	Decision making and Social functions	Introduce one Brain function which relates tot Decision making and social functions

General Course Policies(授業の進め方)		Basic knowledge on brain science, physiology and biology is given.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	To understand Basic knowledges of brain science, physiology and biology
	Couse objectives (具体的な授業の達成目標)	1. To understand the channel dynamics of a neuron 2. To understand the neuron firing 3. To understand the Sensory and Motor Process in a Brain
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Regular examination (70%), and Short report after each lecture.
Assignment Instructions (授業外学習(予習・復習)の指示)		Download the lecture materials and read them before the lecture. Recheck contents of lecture materials and the theme for the reports after each lecture in LiveCampus. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		Neuron, Channel, Gene, Synapse, Brain
Required Textbooks(教科書)		Lecture materials are uploaded in "LiveCampus"
References/Recommended Reading(参考書)		(1) E.R. Kandel, J.H. Schwartz, and T.M. Jessell, "Principles of Neural Science" McGraw-Hill, Health Professions Division, Fifth Edition (2012). (2) N. Carlson "Physiology of Behavior", Global Edition, Pearson Education Limited; 12th Edition (2016).
Notes(備考)		Usually lectures are given in Japanese. However the teacher will have additional class to those who need English explanation.
Email(電子メールアドレス)		natume@brain.kyutech.ac.jp

Course Name(科目名)	Introduction to AI and Robotics		
Instructor Name(担当教員名)	Keiichi HORIO, Takashi MORIE		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	This special course is arranged for students of Car-Robo-AI Joint Graduate School. Ordinary students can take this course, but the lectures are mainly given in Japanese, and the support for international students will be minimum.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.		
	2.		
	3.		
	4.		
	5.		
	6.		
	7.		
	8.		
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)		
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)			
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are expected to set aside 4 hours a week as time for class preparation.		
Keywords(キーワード)			
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)			
Email(電子メールアドレス)			

Course Name(科目名)	AI Seminar		
Instructor Name(担当教員名)	Hakaru Tamukoh		
Course intended for(対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Description(授業の概要)	In this course, students will study about recent key topics of artificial intelligence through lectures and practices. Learning sytems with programming in deep learning frameworks and GPU machines will be introduced to understand about basic deep neural networks, generative models and reinforcement learning.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)			

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Feedforward networks	
	2.	Feedforward networks	
	3.	Regularization for deep learning	
	4.	Regularization for deep learning	
	5.	Optimization for traning deep models	
	6.	Optimization for traning deep models	
	7.	Convolutional networks	
	8.	Convolutional networks	
	9.	Recurrent networks	
	10.	Recurrent networks	
	11.	Autoencoders	
	12.	Autoencoders	
	13.	Generative models	
	14.	Generative models	
	15.	Reinforcement learning	
	16.	Reinforcement learning	

General Course Policies(授業の進め方)	Students are expected to have learned basics of programming.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. Explain the features of various deep learning 2. Have a programming skill for various deep learning 3. Prepare dataset and select a model for a specific task
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Your overall grade in the class is decided based on the followings: weekly report (50%) and examination (50%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	Study the meaning of unknown technical term as preparation for the next lecture. After the class, list the keywords and investigate the research related to that keywords in books or search engine for academic texts. Students are expected to set aside 4 hours a week as time for class preparation.	
Keywords(キーワード)		
Required Textbooks(教科書)	Ian Goodfellow, Yoshua Bengio, Aaron Courville, "Deep Learning", MIT Press, 2016.	
References/Recommended Reading(参考書)		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.	
Email(電子メールアドレス)		

Course Name(科目名)	Advanced Human Intelligence Systems 1			
Instructor Name(担当教員名)	Faculty staffs of Devision of Human Intelligence and Emergent Design			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	This course aims at acquiring a latest and wide view into human intelligence systems and foster better understanding of academic research. All the students introduce a high-quality jounal paper each other.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)				
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)	
	1.			
	2.			
	3.		1-8.	
	4.		Presentation and Discussion	
	5.			
	6.			
	7.			
	8.			
	9.			
	10.			
	11.			
	12.			
	13.			
	14.			
	15.			
	16.			
General Course Policies(授業の進め方)	Each student must receive his/her supervisor's guidance in selecting introduced paper and preparing slide in order to keep quality of the presentation.			
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)			
	Couse objectives (具体的な授業の達成目標)	1.		
		2.		
		3.		
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Submission of worksheets every class (40%), Presentation (40%), Discussion (20%)			
Assignment Instructions (授業外学習(予習・復習)の指示)	Investigate keywords and technical terms which you cannot understand on the presentations. Students are expected to set aside 2 hours a week as time for class preparation.			
Keywords(キーワード)				
Required Textbooks(教科書)				
References/Recommended Reading(参考書)				
Notes(備考)	Usually lectures are given in English.			
Email(電子メールアドレス)				

Course Name(科目名)	Advanced Human Intelligence systems 3			
Instructor Name(担当教員名)	Academic staff of the Division of Human Interaction and Brain Functions			
Course intended for(対象学年)	1st year student			
Credit Category(単位区分)	Elective course		Credits(単位数)	1
Course Description(授業の概要)	This course addresses research topics related to human interaction and brain science. The aim of this course is to help students acquire a better understanding of their own research by obtaining comprehensive knowledge in the division through oral presentations, discussion, and reading of research papers.			
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)				

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.		
	2.		
	3.		1-7.
	4.		Reading exercises to improve reading skills for research papers and related academic textbooks of the Division of Human Interaction and Brain Functions.
	5.		8.
	6.		Exam – Oral presentation in the presence of the professors of the division.
	7.		
	8.		
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		
	16.		

General Course Policies(授業の進め方)		Admission to this course will be decided by conferring with a supervisor.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	
	Couse objectives (具体的な授業の達成目標)	1. 2. 3.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Grading will be based on the level of comprehension of the research topics, and of presentation skills including discussion. The comprehension level is evaluated by a teacher in charge. Presentation skills are evaluated by the professors who attend the oral presentation. The evaluation is classified into five grades.
Assignment Instructions (授業外学習(予習・復習)の指示)		Students are expected to complete all of the following: 1) conduct a preliminary investigation of research topics of a teacher in charge; 2) read related articles; and 3) consider the relation between your research and the research topics in the division. Students are expected to set aside 2 hours a week as time for class preparation.
Keywords(キーワード)		
Required Textbooks(教科書)		Research papers and/or textbooks will be provided to students by a teacher in charge.
References/Recommended Reading(参考書)		
Notes(備考)		This course will be taught in Japanese. Oral presentations and discussion can be conducted in English if a student wishes to do so.
Email(電子メールアドレス)		