Course Name(科目名)	Society and Technology		
Instructor Name(担当教員名)	Dr.Kouichi Nakano		
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)	People who will lead the next technology should go back to the starting point that technology exist for human happiness. The vocational consciousness also should be stand point of human happiness. When you develop a new technology, you must think that the the technology is how usefull for the human happiness. And you must check the public opinion to the technology. The social problems like as environmental affairs or energy problem should be considered from the point of correslation between technology and society. In this lecture, engineers responsibility and morals in a company are explained at first. and then, thechnical strategy of companies, management sence for engineers, the knowledge of a law for enginerrs, material science for engineers, relationship between social environment and a microorganism, joining technology of materials, and a technical trend of some industrial field.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Autonomous learning is recommended and ability of finding a topic or subject and solution for oneself is improved for the developing global engineers.		

	Theme(テーマ)	Contents(内容)
1.	Engineering moral	Engineers responsibility in a company (1)
2.	Engineering moral	Engineers responsibility in a company (2)
3.	Engineering moral	Engineers responsibility in a company (3) exercises
4.	Technical strategy of companies and management sense for engineers (1)	
5.	Technical strategy of companies and management sense for engineers (2)	
6.	The knowledge of a law for engineers (1)	
7.	The knowledge of a law for engineers (2)	
8.	Material science for engineers (1)	
9.	Material science for engineers (2)	
10.	Relationship between social environment and a microorganism (1)	
11.	Relationship between social environment and a microorganism (2)	
12.	Welding and joininng technology of some materials (1)	
13.	Welding and joininng technology of some materials (2)	
14.	A trend of construction engineering (1)	
15.	A trend of construction engineering (2)	

General Course Policies(授業の進め方)		Slides of the power point are used for the lecture. Some questions are asked during the lecture. You can bring in an electronic dictionary and computer etc. Class form is facing or hybrid type between facing and WEB type.
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	(1) Knowing the existence of a lot of social problems like as environmental affairs. (2) Caltivating courage for solving some social problems.
	Couse objectives (具体的な授業の達成目標)	1. Understanding a social responsibility as an engineer 2. Understanding an outline of a law for engineers 3. Cultivating courage for solving a social problem around you
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Your record is evaluate by the points of your reports for some subject mainly.
Assignment Instructions (授業外学習(予習・復習)の指示)		Down load the handout or get it from academic affairs. Please resd it before the class. Make your reports for the subjects indicated at the end of class. Two hours per week are necessary for the preparation of lessons.
Keywords(キーワード)		Social ploblems, Engineers
Required Textbooks(教科書)		Textbooks are not used in this lecture.
References/Recommended Reading(参考書)		Reference books are not specified.
Notes(備考)		Usually the lectures are executed in Japanese language. But one lecture is carried out in English language. So, all attendee of this lecture must submit the reports in English language. Checking attendance is confirmed
Email(電子メールアドレス)		nakano@life.kyutech.ac.jp

Course Name(科目名)	Introduction to Green Technology		
Instructor Name(担当教員名)	Akihiko WATANABE		
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)	It is desirable to take classes in the field of green technology.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Utilization of Renewable Energy for a Sustainable Society 1	
	2.	Utilization of Renewable Energy for a Sustainable Society 2	
	3.	Power semiconductor technology for future electrified society 1	
	4.	Power semiconductor technology for future electrified society 2	
	5.	Nano Materials and Their Application to Solar Cell and Metal Ion Batteries 1	
	6.	Nano Materials and Their Application to Solar Cell and Metal Ion Batteries 2	
	7.	Application of Functional Organic NIR Dyes for Photoelectric	
	8.	Utilization of Electric Energy by Next-generation Semiconductors	
	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	
	16.	Energy technology for zero-emission	

General Course Policies(授業の進め方)		Mainly classroom lectures using PowerPoint.
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 class is to understand the issues and technologies for realizing a prosperous and sustainable society, and the followings are the goals to be achieved.
	Couse objectives (具体的な授業の達成目標)	1. Understand the current status and issues in the field of green electronics. 2. Understand the current status and issues in the field of green technology. 3.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Evaluation based on the score of the report for the assignment given by each lecturer.
Assignment Instructions (授業外学習(予習・復習)の指示)		It is recommended to visit each lecture's website to know the area of research beforehand. Searching books or websites relating to the topics of each lecture will be helpful for your better understanding. Students are expected to set aside 4 hours a week as a time for class preparation.
Keywords(キーワード)		Environment issues, Energy creation, Energy utilization, Green technology
Required Textbooks(教科書)		Materials will be provided in each lecture.
References/Recommended Reading(参考書)		Will be introduced by the lecturer.
Notes(備考)		Strongly recommended for attendance of students who belongs to Dept of Biological Funtions Engineering. Mind the schedule to be announced. 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)		watanabe(a)life.kyutech.ac.jp *Please change (a) to @.

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)	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)	horio@brain.kyutech.ac.jp	

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)	It is desirable to take classes in the field of green electronics.		

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)		Mainly classroom lectures using PowerPoint.
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 class is to understand the issues and technologies for realizing a prosperous and sustainable society, and the followings are the goals to be achieved.
	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 the score of the report for the assignment given by each lecturer.
Assignment Instructions (授業外学習(予習・復習)の指示)		It is recommended to visit each lecture's website to know the area of research beforehand. Searching books or websites relating to the topics of each lecture will be helpful for your better understanding. Students are expected to set aside 4 hours a week as a time for class preparation.
Keywords(キーワード)		Environment issues, Energy creation, Energy utilization, Green Electronics
Required Textbooks(教科書)		Materials will be provided in each lecture.
References/Recommended Reading(参考書)		Will be introduced by the lecturer.
Notes(備考)		This seminar is required to finish the G2E2 cource. 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)		watanabe(a)life.kyutech.ac.jp *Please change (a) to @.

Course Name(科目名)	Exercises on Advanced Robotics Integration I		
Instructor Name(担当教員名)	Eiji Hayashi Yuya Nishida Masahiro Oya		
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 is practical exercises for advanced robotics integration in "Robotics Synthesis & Management Course". The practical exercise explores proactively future robots' development, the management, the service engineering, focusing on the RaaS (Robot as a Service) with a team to solve the issues for consumers. It consists of a series of lectures and meetings, a parallel series of hands-on lab & trainings. The hand-on trainings will have a plan to lead a robot at factory, hospital, shop, office building and so on with the team base on the consumer's requests and demands. After taking this class, the edge-cloud, the management for the robot will be learned and acquired based on RaaS. The course is helpful intermediate-level programming and software operation skills, management and prior		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	A series of this consists of "Exercises on Advanced Robotics Integration I, II and III", and then it needs to continuously take all of "Exercise on Advanced Robotics Integration I,II and III" depending on the admission period is in April or October.		
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1. Understanding robot/AI on RaaS		
	2. Data analysis on robot behavior		
	3. Research for location to introduce r		
	4. Plan and Introduction for robot		
	5. Group discussion(1)		
	6. Design robot behavior that facilitate		
	7. Management plan		
	8. Robot operation plan		
	9. Group discussion(2)		
	10. Hand-on Training (1)		
	11. Hand-on Training (2)		
	12. Hand-on Training (3)		
	13. Group discussion(3)		
	14. Group discussion(4)		
	15. Presentation		
General Course Policies(授業の進め方)	About 5 students will make up a team, and try to mainly do the monthly meeting with Savioke, San Jose, the hand-on lab & training etc.		
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. Team's communication for searching and finding a solution 2. Engineering for taking control of the issues. 3. Sharing information and development for regions and global technologies	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Pier review by students (20%), homework, report, and presentation(80%)		
Assignment Instructions (授業外学習(予習・復習)の指示)			
Keywords(キーワード)			
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)	【Language to use】Japanese, English		
Email(電子メールアドレス)	[redacted] oya@cntl.kyutech.ac.jp		

Course Name(科目名)	Exercises on Advanced Robotics Integration Ⅱ		
Instructor Name(担当教員名)	Eiji Hayashi　Yuya Nishida　Masahiro Oya		
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 is practical exercises for advanced robotics integration in "Robotics Synthesis & Management Course". The practical exercise explores proactively future robots' development, the management, the service engineering, focusing on the RaaS (Robot as a Service) with a team to solve the issues for consumers. It consists of a series of lectures and meetings, a parallel series of hands-on lab & trainings. The hand-on trainings will have a plan to lead a robot at factory, hospital, shop, office building and so on with the team base on the consumer's requests and demands. After taking this class, the edge-cloud, the management for the robot will be learned and acquired based on RaaS. The course is helpful intermediate-level programming and software operation skills, management and prior experience in robotics or artificial intelligence but not required.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	A series of this consists of "Exercises on Advanced Robotics Integration I, II and III", is a prerequisite for taking "Robotics Synthesis & Management Course" and earning "Exercises on Advanced Robotics Integration I". However, if this course's teachers permit to taking this course, this course can be taken without earning "Advanced Robotics Integration I".		
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Understanding robot/AI on RaaS	
	2.	Data analysis on robot behavior	
	3.	Research for location to introduce r	
	4.	Plan and Introduction for robot	
	5.	Group discussion(1)	
	6.	Design robot behavior that facilitate	
	7.	Management plan	
	8.	Robot operation plan	
	9.	Group discussion(2)	
	10.	Hand-on Training (1)	
	11.	Hand-on Training (2)	
	12.	Hand-on Training (3)	
	13.	Group discussion(3)	
	14.	Group discussion(4)	
	15.	Presentation	
General Course Policies(授業の進め方)	About 5 students will make up a team, and try to mainly do the monthly meeting with Savioke, San Jose, the hand-on lab & training etc..		
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. Team's communication for searching and finding a solution 2. Engineering for taking control of the issues. 3. Sharing information and development for regions and global technologies	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Pier review by students (20%), homework, report, and presentation(80%)		
Assignment Instructions (授業外学習(予習・復習)の指示)			
Keywords(キーワード)			
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)	【Language to use】Japanese, English		
Email(電子メールアドレス)	Eiji Hayashi　haya@mse.kyutech.ac.jp　Yuya Nishida　y-nishida@brain.kyutech.ac.jp Masahiro Oya　oya@cntl.kyutech.ac.jp		

Course Name(科目名)	Exercises on Advanced Robotics Integration Ⅲ		
Instructor Name(担当教員名)	Eiji Hayashi　Yuya Nishida　Masahiro Oya		
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 is practical exercises for advanced robotics integration in "Robotics Synthesis & Management Course". The practical exercise explores proactively future robots' development, the management, the service engineering, focusing on the RaaS (Robot as a Service) with a team to solve the issues for consumers. It consists of a series of lectures and meetings, a parallel series of hands-on lab & trainings. The hand-on trainings will have a plan to lead a robot at factory, hospital, shop, office building and so on with the team base on the consumer's requests and demands. After taking this class, the edge-cloud, the management for the robot will be learned and acquired based on RaaS. The course is helpful intermediate-level programming and software operation skills, management and prior experience in robotics or artificial intelligence but not required.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	A series of this consists of "Exercises on Advanced Robotics Integration I, II and III", is a prerequisite for taking "Robotics Synthesis & Management Course" and earning "Exercises on Advanced Robotics Integration I and II". However, if this course's teachers permit to taking this course, this course can be taken without earning "Advanced Robotics Integration I or II".		
Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1. Understanding robot/AI on RaaS 2. Data analysis on robot behavior 3. Research for location to introduce r 4. Plan and Introduction for robot 5. Group discussion(1) 6. Design robot behavior that facilitate 7. Management plan 8. Robot operation plan 9. Group discussion(2) 10. Hand-on Training (1) 11. Hand-on Training (2) 12. Hand-on Training (3) 13. Group discussion(3) 14. Group discussion(4) 15. Presentation		
General Course Policies(授業の進め方)	About 5 students will make up a team, and try to mainly do the monthly meeting with Savioke, San Jose, the hand-on lab & training etc.		
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. Team's communication for searching and finding a solution 2. Engineering for taking control of the issues. 3. Sharing information and development for regions and global technologies	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Pier review by students (20%), homework, report, and presentation(80%)		
Assignment Instructions (授業外学習(予習・復習)の指示)			
Keywords(キーワード)			
Required Textbooks(教科書)			
References/Recommended Reading(参考書)			
Notes(備考)	【Language to use】Japanese, English		
Email(電子メールアドレス)	Eiji Hayashi haya@mse.kyutech.ac.jp　Yuya Nishida y-nishida@brain.kyutech.ac.jp Masahiro Oya oya@cntl.kyutech.ac.jp		

Course Name(科目名)	Exercises on Team Management (ETM)		
Instructor Name(担当教員名)	Doosub Jahng, Kazuo Ishii, Eiji Hayashi		
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)	1
Course Description(授業の概要)	Management Project is a project course that is related to AI Robotics in the Robotics Synthesis & Management course. Various perspectives are needed to address issues that are faced by regional Society. In the field of robotics, when considering further development of robots, it is important to embody the technical approach from the viewpoint of utilization and application, service, and management in addition to the acquisition of advanced technology. And then, this project cooperates the educational institutions and companies related to the management, common issues and themes for community benefit are inquired with businessperson, professor, student and so on related to that. And it promotes abilities that are a fusion of the management & the engineer, and the presence in the society. In this course, students will take the initiative in service planning, creating proposals, and practicing management for the coexistence and revitalization of regional societies. In the series of processes. Throughout their hands-on learning experiences, students will practice and learn about team building, activities, and evaluation in order to		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Robotics Synthesis & Management course is a prerequisite for this course.		

Course Calendar/Class Topic (授業計画)		
	Theme(テーマ)	Contents(内容)
1.	Learning Tools Guidance	Key Words Meeting (KWM ®), Table Whiteboard, Multiscreen, and KW
2.	System and Management	Definitions and Differences, PDCA Cycle, Relationship with Team
3.	Team	Definition, Descriptions, Communication Hierarchy of Team Communi
4.	Intra-personal Communication	Intra- and Inter-, SWOT Analysis
5.	League Match: Proposal & Preparation (1)	Finally Choosing the proposal which is a high feasibility through the league match
6.	League Match: Proposal & Preparation (2)	
7.	League Match: Proposal & Preparation (3)	
8.	League Match: Proposal & Preparation (4)	
9.	Interim report & Presentation	
10.	League Match (1)	We'll vote on which would be the best proposal.
11.	League Match (2)	
12.	League Match (3)	
13.	League Match (4)	
14	Preparing final report & presentation	
15	Final presentation	
16		

General Course Policies(授業の進め方)		Group Work: The divided 4 teams will proceed with the stages of creating a proposal, obtaining permission, and implementing while receiving consultations based on pre-learning. ・Pre-learning : TM's podcast (DJ Tayori – Anchor, DJ Tayori – Google Podcasts etc.) and the reference materials are provided ・Q&A and discussion b Zoom and so on ・Accountability of learning process upload on KWM (Key Words Meeting) http://www.brain.kyutech.ac.jp/~jahng/wp/?page_id=242
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. Team's communication for searching and finding a solution 2. Engineering for taking control of the issues. 3. Sharing information and development for regions and global technologies
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Interim presentation (20%), Final presentation (30%), Investigation reports (10%), Final report(40%)
Assignment Instructions (授業外学習(予習・復習)の指示)		Extensive pre-class preparation, in-class participation and reflection on 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 for class preparation.
Keywords(キーワード)		Teaming (Building, Operating, Evaluating), Planning, Feasibility, Presentation
Required Textbooks(教科書)		
References/Recommended Reading(参考書)		Doosub Jahng, Three Fundamentals of Efficient Worklife in Team, JISHA, 2003 (Japanese) You Tube, DJ Tayori: Street Professor. The 12 episodes on Kizukino Tabi
Notes(備考)		International Student Due to the theme of this course (coexistence and revitalization with regional society), Japanese will be the primarily language used. Please use this opportunity to practice using Japanese. Having a Japanese tutor may be helpful if further support is needed.
Email(電子メールアドレス)		jahng@brain.kyutech.ac.jp, ishii@ brain.kyutech.ac.jp, haya@mse.kyutech.ac.jp

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.		
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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)	horio@brain.kyutech.ac.jp	

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.		
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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)	horio@brain.kyutech.ac.jp	

Course Name(科目名)	Semiconductor Power Devices		
Instructor Name(担当教員名)	Ichiro Omura		
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)	Semiconductor Power Devices are widely used in energy management and power control such as motor drive circuits and power supplies. The lecture includes topics of semiconductor physics, device design of power MOSFET, IGBT and PiN diodes, reliability, device packaging 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. Power electronics and power devices	
	2. Basics of semiconductor physics 1	
	3. Basics of semiconductor physics 2	
	4. Formulation of power device design	
	5. Breakdown voltage design	
	6. PN-diodes	
	7. PiN-diodes	
	8. Power MOSFETs	
	9. IGBT	
	10. High power IGBT	
	11. Edge termination design	
	12. Safe operating area	
	13. Cosmic ray induced failure	
	14. Future of Power devices	
	15. Report presentations	

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)	Group project activity and presentation	
Assignment Instructions (授業外学習(予習・復習)の指示)		
Keywords(キーワード)		
Required Textbooks(教科書)	Handout A. Grove, "Physics and Technologies of Semiconductor Devices," John and Wiley & Sons.	
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)	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.	software for power electronics	how to use MATLAB/Simulink for power electronics application are
3.	Power Semiconductor devices and power conversion	Principle operation of power semiconductor as a switch are lectured
4.	DC-DC conversion (principle and buck converter)	Principle of the power converter using power semiconductor and bu
5.	DC-DC conversion (boost converter and buck boost converter)	DC to DC power conversion using boost and buck-boost type of the
6.	exercise of DC-DC conversion	Some excersise of DC-DC conversion using MATLAB/Simulink are
7.	DC-AC conversion(single phase inverter)	DC to AC power conversion of single phase inverter is lectured
8.	DC-AC conversion(three phase PWM inverter)	DC to AC power conversion of three phase inverter is lectured
9.	exercise of DC-AC conversion	Some excersise of DC-AC conversion using MATLAB/Simulink are
10.	Principle of the electrical motors	Principle of electrical to mechanical conversion and the structure of
11.	Coordinate transformation and mathematical model of AC motor	Mathematical model of both DC and AC motors are lectured
12.	Control system design and Feedback control of DC-DC converter	Principle of the control theory and feedback control are lectured
13.	Control method of the motor driving (Vector control)	Variable speed control of the motor and the equivalent circuit of AC
14.	Observer based control (Disturbance torque control and position sensorless control)	Disturbance observer and position sensorless control using observer
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 "Moodle". 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 in the class. 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 single and three phase inverter 2. understanding of the principle of the permanent magnet synchronous motor (PMSM) and variable speed control of PMSM 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 Moodle . 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 "Moodle".
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)	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 physics in 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)	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	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 a
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.	Microliquid handling devices	Droplet transportation using wettability gradient, Electrowetting, Sup
11.	Cell analysis devices 1	Cell stimulation devices
12.	Cell analysis devices 2	Co-culture devices, Extracellular potential measuring devices
13.	Electrostatic manipulation of biological samples	Cell manipulation and blood separation using dielectrophoresis, Elect
14.	Biomolecule detection devices 1	Electrochemical measurement, LSPR-based biosensing
15.	Biomolecule detection devices 2	QCM detection, Fluorescence detection
16.		

General Course Policies(授業の進め方)	All lectures are given online with documents and videos on Moodle. An assignment is given in 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 is determined by quality of all assignment reports.	
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)	Reference literatures are given in the course materials which can be downloaded from Moodle.	
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)	It is desired to learn subjects on dynamics of machinery and design of machine elements in undergraduate course.		

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)		Dynamics of machinery, Rigid body, Vibration, Design of machine elements, Motion, Sense, Measurement of living tissue
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)	Students are expected to have studied subjects of mechanics.		
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 [illegible])	
		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)		PowerPoint slides are used in the lecture. Short report sould be submitted in each class using a personal computer. The lecture is basically face-to-face style and partially online style every week.	
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 understand the mechanical behavior of living tissues. There are three objectivese as listed below.	
	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 for 4 hours per week.		
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 in each class.		
References/Recommended Reading(参考書)	References are introduced in each class.		
Notes(備考)	It is imortant to understand the mechanics. Basics of Newtonian mechanics, strangth of materials and continuum mechanics are explained in the class. 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)	yamada@life.kyutech.ac.jp		

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	
Course Objectives (授業の達成目標) — 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, Composites	
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)	It is desirable to finish courses such as solid-state physics and microstructures of materials at university faculties or technical colleges.			
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)	Lecture will be proceed using slides and carrying out exercises.			
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)	Quantum mechanics, solid-state physics, statistical mechanics, thermodynamics			
Required Textbooks(教科書)	Will be introduced in the class.			
References/Recommended Reading(参考書)	Reference materials for each lecture will be described in the handouts.			
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)	Clean Cycle Chemistry based on Microbial Functions		
Instructor Name(担当教員名)	Toshinari MAEDA		
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)	Bacterial can adapt any enviroments such as high salinity, acidic, alkaline, high pressure conditions. The adaptation can be regulated by the gene expression (on-off switch), gene mutation, and protein evolution. As a result, there are several unique bacterial functions by which bacterial cannibalism, biofilm formation, cell-to-cell communication, and bioenergy production can be seen as a bacterial event. The objective of this lecture is to understand how living organisms can adapt and regulate the functions and how the bacterial functions can be applied to an eco-friendly technology.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	For the education and research in clean cycle chemistry, it is at least necessary to study the following four academic fields of chemistry, chemical engineering, physical chemistry, and biochemical engineering (the four core fields of clean cycle chemistry regarding the element circulation). In this lecture, we will deepen our understanding from the academic field of chemistry and biochemical engineering using microbial functions.		

Course Calendar/Class Topic (授業計画)

	Theme(テーマ)	Contents(内容)
1.	Element circulation and microbial functions	Outline the role of microbial functions in elemental circulation
2.	DNA and structure of chromosome DNA	Explain the structure and function of DNA
3.	DNA replication, repair, and gene mutation	Explain the mechanism of DNA replication, repair, and mutation
4.	Central Dogma	Explain the transcription and translation mechanisms involved in the
5.	Gene expression	Explain the mechanism of gene expression
6.	Regulation of gene expression	Explain the mechanism to regulate the gene expression
7.	Translation ―Messenger RNA to Protein―	Explain the translation mechanism via various RNA molecules
8.	Protein and enzyme and its catalytic mechanism	Explain the function of proteins and enzymes
9.	Protein evolution	Explain the mechanism how to evolve protein functions
10.	Strategy of bacterial predation and cannibalism	Explain bacterial survive through predation and cannibalism
11.	Cell-to-cell communication and bacterial quorum sensing	Explain the mechanism of bacterial quorum sensing
12.	Bacterial chemotaxis and other environmental adaptation by bacteria	Explain the mechanism of bacterial chemotaxis and acid resistance
13.	Biodegradation of environmental pollutants and bioremediation	Explain the mechanism of biodegradation for environmental pollutant
14.	Reduction and utilization of Waste activated sludge	Explain the system to reduce and utilize waste activated sludge
15.	Future environmental biotechnology	Expain the future substance circulation using biotechnologies
16.	Examination	Examine the levels of undestanding and discussion

General Course Policies(授業の進め方)		In this lecture, the first lecture and the final examination will be conducted face-to-face and the remaining lectures will be conducted asynchronously using the Moodle system.
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 lecture is to acquire the knowledge of microbial functions in the chemical cycle, and the following contents are the goals to be achieved.
	Couse objectives (具体的な授業の達成目標)	1. Basic knowledge about microbial functions 2. Knowledge of applied (practical) technology of microbial functions 3. Connection between basics and applications (practical use) 4. Ability to link with your own research field 5. Ability to summarize and apply clean cycle chemistry (chemical cycle of elements)
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Short test in each lecture and final examination
Assignment Instructions (授業外学習(予習・復習)の指示)		Be sure to download the lecture materials posted on Moodle system in advance and read them before taking the lecture. The information about the Moodle course will be contacted at the beginning of the lecture or at Live Campus. In addition, review the points shown at the end of the lecture.
Keywords(キーワード)		DNA, Bacteria, Biotechnology
Required Textbooks(教科書)		Voet D., Voet J.G.; Biochemistry, 4th Edition
References/Recommended Reading(参考書)		Nothing
Notes(備考)		English lecture will be available; at the first lecture, the detail will be explained.
Email(電子メールアドレス)		toshi.maeda@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 course will be more or less demanding depending on the initial level in chemistry and biology.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)		The lecture will be given using MS Power Point. In the first half of the lecture, the items (1) to (9) above will be discussed, and the basics of biomolecules will be explained. In the second half, lectures on applied technologies related to this lecture will be given, and in the last half, explanations on the latest technologies will be given based on academic papers in English. Small tests will be given during the lecture to check the students' understanding.
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)	Clean Cycle Chemistry based on 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)	For education and research in clean cycle chemistry, it is necessary to cover the 4 academic fields of chemistry, chemical engineering, physical chemistry, and biochemical engineering (4 core fields of element cycle chemistry). In this course, students will deepen their understanding of clean cycle chemistry by learning photochemistry from the field of chemistry and physical chemistry.		

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

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 solar cell. Moreover, overlooking of clean cycle chemistry by relating with student's research field are also course objectives.
	Couse objectives (具体的な授業の達成目標)	1. Students be able to understand basic principle of photofunctional materials and their application 2. Students be able to explain connection between basic principle and application 3. Students be able to overlook clean cycle chemistry by relating with student's research field
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, photocatalyst, photoelectrode, solar cell, semiconductor
Required Textbooks(教科書)		Will be introduced in the class
References/Recommended Reading(参考書)		Will be introduced in the class
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 through studying 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	Background of the birth of mechatronics	
	2.	Dynamics and Mechanics (1)	Derivation of one-degree-of-freedom vibration system, Laplace trar	
	3.	Dynamics and Mechanics (2)	Specific examples of integral system/1st order system/2nd order sy	
	4.	Dynamics and Mechanics (3)	Identification method of Contrled target; Time response and Freque	
	5.	Acutators – Principle of motor	Principle to drive an electric motor, Basic concept of motor capacity	
	6.	Real-time control (1) ; Feedback control #1	Needs for feedback control; Stabilization and Robustness, Velocity c	
	7.	Real-time control (2) ; Feedback control #2	Aligning responses using the feedback control system, PID control, I	
	8.	Real-time control (3) ; Feedback control #3	Overview of feedback control systems, Feedback control systems u	
	9.	Real-time control (4) ; Feedforward control and 2-degree of freedom control	What is ″feedforward control″?, Why do we need a ″two-degree-of-	
	10.	Real-time control (5) ; Advanced control	Advanced Control Overview, Advanced Controllers Commonly Used	
	11.	Design a control system-Feedback control; Inverted pendulum	Frequency response acquisition demo. Velocity loop proportional gai	
	12.	Sequence Control (1) ; Introduction, Components, Design logical circuits#1	What is ″sequence control″? , Components used in sequence contr	
	13.	Sequence Control (2) ; Design logical circuits#2	What is ″interlock″ ?, Operating principle of relay memory circuit, Lo	
	14.	Sequence Control (3) ; Tools to design sequence control systems, Design an automatic vending machine	Tools for sequence control design; timing chart, flowchart	
	15.	Conponents of Mechatronics system	Overview of components used in mechatronics systems	
General Course Policies(授業の進め方)	This course uses PowerPoint and is held as a remote lecture (asynchronously). Every time, presented by dividing the lectures in the first half, the second half of the two videos (In Moodle), to implement a small test between the first half and the second half. Presents exercises to make sure every level of understanding in the			
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 exercises given at the end of each lecture. [Remote Lecture ; Asynchronous style] For odd-numbered lectures (the first one will be on April 12th (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 presented in Moodle before each class. Students are expected to set aside 4 hours a week as time for class preparation.			
Keywords(キーワード)	Equation of motion, Laplace transform, Principle to drive an electric motor, Mechatronics system, Real-tome control, Sequence control			
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)	Semiconductor Materials and Devices		
Instructor Name(担当教員名)	Akihiko Watanabe		
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 modern society, various industries and social infrastructure such as electric power, telecommunications, and transportation are supported by semiconductors. In addition, technological progress in semiconductors is responsible for the creation of a new society. In this lecture, we will give lectures on semiconductor materials, basics of semiconductor physical properties, various semiconductor devices, and future semiconductor devices.		
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 desirable to take classes in the field of electrical and electronic materials and semiconductor device.		

Course Calendar/Class Topic (授業計画)	Theme(テーマ)	Contents(内容)
	1. Crystal and energy band (1)	
	2. Crystal and energy band(2)	
	3. Carrier and electrical conduction(1)	
	4. Carrier and electrical conduction(2)	
	5. Semiconductor and metal joint(1)	
	6. Semiconductor and metal joint(2)	
	7. Compound semiconductor(1)	
	8. Compound semiconductor(2)	
	9. Wide gap semiconductor(1)	
	10. Wide gap semiconductor(2)	
	11. Optical properties(1)	
	12. Optical properties(2)	
	13. Power semiconductor(1)	
	14. Power semiconductor(2)	
	15. Semiconductors in the future	

General Course Policies(授業の進め方)		Classroom lectures using PowerPoint, Practice, Survey and presentation
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 class is to understand the basic properties of semiconductor materials, as well as their applied technologies and new materials, and the following items are the goals to be achieved.
	Couse objectives (具体的な授業の達成目標)	1. Understand the energy band 2. Understand various semiconductor devices 3. Understand the new semiconductor materials and its application
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		Evaluation based on the score of the report for the assignment.
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 a time for class preparation.
Keywords(キーワード)		Semiconductor crystals, energy bands, wide-gap semiconductors, semiconductor devices
Required Textbooks(教科書)		Materials will be provided in each lecture.
References/Recommended Reading(参考書)		Introduction to Solid State Physics / Charles Kittel Semiconductor Devices – Physics and Technology / S.M.Sze
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)		watanabe(a)life.kyutech.ac.jp *Please change (a) to @.

Course Name(科目名)	Collaborative Brainstorming on Clean Cycle Chemistry		
Instructor Name(担当教員名)	Haruyama, Maeda, 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)	For solving environmental and energy problems and contributing to a sustainable society, it is necessary to acquire a new perspective by interdisciplinary fusion. This course aims to develop engineers and researchers who contribute to a sustainable society by proposing collaborative research with different fields. This course will be provided by 3 divisions as following; "Engineering and technology research for realization of a concept of clean cycle chemistry (Tri-C)" by Professors/Associate Professors of clean cycle chemistry course. In addition, lectures by researchers invited from other than Kyutech who are conducting research and development on recyclable chemistry will also be provided. In the latter half of the lecture, the graduate students will present the concept of sustainable chemistry that can be realized by collaboration between their		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	For education and research in Clean Cycle Chemistry (Tri-C), it is necessary to cover the 4 academic fields of chemistry, chemical engineering, physical chemistry, and biochemical engineering (4 core fields of element cycle chemistry). In this course, students will deepen their understanding of Tri-C through lectures of research and development activities for Tri-C and student proposal of collaborative research.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Guidance	
	2.	Engineering and technology research	
	3.	Engineering and technology research	
	4.	Engineering and technology research	
	5.	Discussion I	
	6.	Discussion II	
	7.	Latest domestic trends on Clean Cy	
	8.	Latest domestic trends on Clean Cy	
	9.	Presentation I	
	10.	Presentation II	
	11.	Presentation III	
	12.	Presentation IV	
	13.	Short presentation by all the studen	
	14.	Short presentation by all the studen	
	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. Significance and effect in collaborative research 2. Feasibility as Clean Cycle Chemistry 3. Appeal in proposal of collaborative research 4. Persuasiveness of presentation
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: Activity performance based on following the above: 80%. Short presentation by all the students: 20%	
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)	Clean Cycle Chemistry, Functional interface engineering, Environmental bio-adaptation, Photo-functional materials, Electrocatalytic engineering	
Required Textbooks(教科書)	Textbooks will be not used.	
References/Recommended Reading(参考書)	Will be introduced in the class.	
Notes(備考)		
Email(電子メールアドレス)	murakami@life.kyutech.ac.jp	

Course Name(科目名)	Exercises on Computational Biomechanics		
Instructor Name(担当教員名)	Hiroshi Yamada, Masaaki Tamagawa, Kazuto Takashima, Tomohiro Kawahara		
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 deals with basic techniques of formulating and solving initial boundary value problems with a computer for a variety of mechanical phenomena in a human body. It enhances the students' skills in using the well-known software such as Abaqus, ANSYS and MATLAB to solve basic boundary value problems in the fields of solid mechanics, fluid dynamics, dynamics of machinery and thermodynamics.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	Students are requiered to have the knowledge of the strength of materials, fluid dynamics, dynamics of machinery and thermodynamics.		

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Finite element analysis of solid structures: identification of the material properties of a soft elastic material in a mechanical loading	
2.	Finite element analysis of solid structures: deformation of the blood vessel and stresses in the soft tissue	
3.	Computational fluid dynamics: numerical analysis of flows on pipe and stenosis which are models of blood vessels	
4.	Computational fluid dynamics: numerical analysis of flows on pipe and stenosis which are models of blood vessels	
5.	Numerical analysis for dynamics of machinery: motion analysis of rigid body pendulum	
6.	Numerical analysis for dynamics of machinery: motion analysis of human joint	
7.	Numerical analysis on the thermodynamics: programming for the thermal conduction problem	
8.	Numerical analysis on the molecular dynamics: programming for the three-body problem with empirical potential	
9.		
10.		
11.		
12.		
13.		
14.		
15.		

General Course Policies(授業の進め方)		Students need to bring laptop comptuers and use desktop computers in a computer room. The computer room in the Division of Biological Mechanics is used for the exercises on finite element analyses of solid mechanics (1, 2) and the computer terminal room No. 1 is used for the other excercises (3-8).
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	The main objective is to study computing methods in biomechanics. There are three objectives as listed below.
	Couse objectives (具体的な授業の達成目標)	1. Understanding of finite element methods for the deformation of tissues in the field of biosolid mechanics 2. Understanding of computational methods for incompressible flow analysis in the field of fluid dynamics 3. Understanding of modeling, programing, and analysis methods for dynamics of machinery
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 your results of tasks in the exercises.
Assignment Instructions (授業外学習(予習・復習)の指示)		As preparations, students need to study fundamentals of the exercises, e.g., the strength of materials, fluid dynamics, dynamics of machinery and thermodynamics. As reviews, students need to understand the excercises deeply by studying the theories used in the class.
Keywords(キーワード)		Biomechanics, Finite element method, Finite difference method
Required Textbooks(教科書)		Materials may be provided in each class as a text book.
References/Recommended Reading(参考書)		References may be introduced in 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)		yamada@life. kyutech. ac. jp

Course Name(科目名)	Exercises on Measurement Control Systems		
Instructor Name(担当教員名)	Akihiko WATANABE, 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)	It is desirable to take classes in the field of measurement control.		
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. Exercise of Measurement with Microcomputer 6. Design and make a Measurement Control System (1) 7. Design and make a Measurement Control System (2) 8. Presentation of System with Microcomputer 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)	Practice using a PC. Bring the notebook computer lent by the department.		
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 class is to acquire the skill of measurement, control, signal processing and analysis of device structure, and the followings are the goals to be achieved.		
Course Objectives (授業の達成目標) 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 2 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)	Getting Started with Arduino: The Open Source Electronics Prototyping Platform (Make) / M.Banzi and M.Shiloh		
Notes(備考)	Study materials will be suggested for prior study. Do not be absent without permission. 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)	watanabe(a)life.kyutech.ac.jp; shyam(a)life.kyutech.ac.jp *Please change (a) to @.		

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)	horio@brain.kyutech.ac.jp	

Course Name(科目名)	Robot Kinematics		
Instructor Name(担当教員名)	Kazuo Ishii		
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)	Robots are expected as new tools and play active roles in various fields due to high performance computers. Robotics is one of the comprehensive engineering, and the development of robots requires a wide range of knowledge such as mechanical engineering, electrical and electronic engineering, and information engineering. In this lecture, the basic knowledge to analyse robot motion 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)	The basics knowledge for analysing the robot motion.		

	Theme(テーマ)	Contents(内容)
1.	Introduction to Robotics	Various robots are introduced for the discussion of robot developme
2.	Trend on Robotics Research	The motivation and necessity of robots R&D are discussed.
3.	Units	Units system is very important. review the units and their relations.
4.	Mathematics for Robotics	Basic mathematics for robot motion representation are shown.
5.	Rigid Body Kinematics (Translational Motion, Rotational Motion)	The rigid body is the basic components of robot motion. To think ro
6.	Rigid Body Kinematics(Absolute Motion)	For reprentation of rigid body motion, absolute motion is explained.
7.	Rigid Body Kinematics(Relative Motion)	For reprentation of rigid body motion, relative motion is explained.
8.	Rigid Body Kinematics(Link Mechanism, Instant Center of Velocity)	For reprentation of rigid body motion, instant center of motion is ex
9.	Coordinate Transformation	To consider the relation of link bodies, the coordinate transformatio
10.	Homogeneous Transformation	To consider the relation of link bodies, the homogeneous transforma
11.	Forward Kinematics, Inverse Kinematics	The input/output relation (robot angle and end effector position) is
12.	Jacobian Matrix and Output Force	Jacobian matrix to represent robot angle moment and end-effector
13.	Rigid Body Dynamics	Robot dynamics is introduced.
14.	Equations of Motion	Equations of motion are explaned to represent robot trajectory.
15.	Robot Control	Robot control systems are introduced.

Course Calendar/Class Topic (授業計画)

General Course Policies(授業の進め方)	The documents for the course are uploaded on the moodle. After each class, the report to evaluate the understandings should be submitted.	
Course Objectives (授業の達成目標)	Introduction to Couse Objectives (授業の達成目標の解説)	In this class, you are asked to describe how to take a coordinate system to express the movement of a robot, the movement (position, speed, acceleration) of arbital point on the robot (rigid body), and their relational expressions. The goal is to understand the relationship between positions and forces.
	Couse objectives (具体的な授業の達成目標)	1. understand the rigid body motion 2. understand the robot kinematics 3. understand the relation of position and force.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	In each class, ask an short exam about the topics.	
Assignment Instructions (授業外学習(予習・復習)の指示)	After each class, the report to evaluate the understandings should be submitted.	
Keywords(キーワード)	Rigid body, Kinematics, Dynanmics	
Required Textbooks(教科書)	Meriam, Mechanical Dynamics	
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)	ishii@brain.kyutech.ac.jp	

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	Mechanism of hearing
5.	Substitution for auditory system	Assistive device for hearing
6.	Motor system: Vocalization and its substition	Mechanism of vocalization and assistive device for vocalization
7.	Motor system: Bone, muscle, upper limb, lower limb, trunk	Mechanism of bone, muslce, limb and trunk
8.	Substitution for motor system	Assitive device for motor function
9.		
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)		Medical textbook on anatomy and physilogoy will be helpful.
Notes(備考)		Course materials are written in English, but 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)	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 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.	Neuromorphic hardware	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		
General Course Policies(授業の進め方)	The classes are given using lecture material uploaded at Moodle. Students are requested to submit a mini-report after every 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. 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 "Moodle". 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)	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.:			
Course Objectives (授業の達成目標) — 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)	Textbook on LabVIEW and Matlab will be helpful.			
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)	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	Outline the sensors used in robots.
2.	Sensor and singal processing : basics	Explain the flow of sensor signals, typical characteristics, and prepro
3.	Operating principles and circuit technology of sensors (1/2)	Explain the sensing method for position and displacement
4.	Operating principles and circuit technology of sensors (2/2)	Explain the sensing methods for force and momentum
5.	Probability and statistics for sensing : basics 1	Review probability and statistics as a tool to consider how to expres
6.	Probability and statistics for sensing : basics 2	Review probability and statistics as a tool to consider how to expres
7.	Probability and statistics for sensing : advance 1	Explain regression problems, classification problems/generative mod
8.	Probability and statistics for sensing : advance 2	Explain the graphical model
9.	Sensor control 1	Explain lower level control of robots using sensor information (1)
10.	Sensor control 2	Explain lower level control of robots using sensor information (2)
11.	Sensor fusion 1	Explain how to estimate the state of own and surrounding environme
12.	Sensor fusion 2	Explain how to estimate the state of own and surrounding environme
13.	bio-inspired sensory system : basics	Explain biological sensory information processing
14.	bio-inspired sensory system : advance	Explain bio-inspired sensory system
15.	Summary	Summarize the content of the lecture
16.		

General Course Policies(授業の進め方)		The slides will be used for explanation. Some lectures will be given remotely.
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)		Computer vision: models, learning, and inference, Prince, Simon JD. Probabilistic Robotics, Sebastian Thrunm, Wolfram Burgard, Dieter Fox
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	As learning models required in this lecture, we will learn the features
2.	Least Squares Learning	Using the regression problem as an example, we will learn about the
3.	Constrained Least Squares Learning	Understand the problems of the least squares method and learn abo
4.	Sparse Learning	Learn about sparse learning that leverages the constrained least sq
5.	Classification based on Least Squares Learning	Learn about objective functions suitable for classification problems
6.	Support Vector Machines	Understand the concept of margins in classification problems and le
7.	Ensemble Learning	In the classification problem, learn about ensemble classification tha
8.	Summary	Review the lessons and touch on developing topics.
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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	Learn how to detect anomalous data contained in observational data
2.	Unsupervised Dimensionality Reduction	Learn the points to note when dealing with high-dimensional data ar
3.	Clustering	Learn how to divide a data set into subsets called multiple clusters
4.	Online Learning	Learn how to learn when data is obtained sequentially, not in a situa
5.	Semi-superbised Learning	Learn how to learn when correct answer information is given to only
6.	Supervised Dimensionality Reduction	Learn about the problems of high-dimensional data in classification
7.	Transfer Learning, Multi-task Learning	Learn the methodology when the characteristics of the training data
8.	Summary	Review the lessons and touch on developing topics.
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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 and Boltzmann Machines 6. Deep Leanring Basics 7. Deep Learning Applications 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) Devid Mar: Vision, The MIT Press, 1982. (2) Probabilistic Models of the Brain, The MIT Press, 2002		
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)	It is preferred to take lectures on machine learning basics in Q1 and Q2, but it is not mandatory. It is preferred to take Brain-Inspired Learning Theory A, but it is not mandatory.		

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. Then, the problem setting of reinforcement learning will be
	2. Multiarm Bandit Problem & Markov Decision Process	As a preparation to learn reinforcement learning algorithms, we will first look at the multi-armed Bandit problems. Subsequently, we will look at the Markov Decision Process (MDP), which is the basis for solving the reinforcement learning problems.
	3. Value-function, Bellman equation	We will learn the Bellman equations, which the value functions satisfy. Then, we will learn the Q-learning, which is one of the most famous RL methods.
	4. Policy Gradient	We will learn the policy gradient, which is a core algorithm for training a policy in RL.
	5. On-Policy Actor Critic Methods	We will learn on-policy actor critic methods e.g., A2C, which are more sample-efficient than the policy gradient.
	6. Off-Policy Actor Critic Methods	We will learn off-policy actor critic methods e.g., DDPG, which are sample-efficient for many continuous control tasks.
	7. Inverse Reinforcement Learning	We will learn the inverse reinforcement learning (IRL), which estimates the unknown reward function from the expert's behavior.
	8. Frontiers of RL & Summary	The state-of-the-art methods of RL will be explained.
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	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 the reinforcement learning theory 3. understand how to implement 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 based on the results of the quiz, homework assignment, 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)	osa@brain.kyutech.ac.jp	

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)	This course is not recommended for students who have mastered basic image processing technologies.		

Course Calendar/Class Topic (授業計画)		Theme(テーマ)	Contents(内容)
	1.	Introduction of Visual Information Processing	
	2.	Fundamentals of Visual Information Processing (1)	
	3.	Fundamentals of Visual Information Processing (2)	
	4.	Color Image Processing (1)	
	5.	Color Image Processing (2)	
	6.	Advanced Visual Information Processing (1)	
	7.	Advanced Visual Information Processing (2)	
	8.	Advanced Visual Information Processing (3)	
	9.		
	10.		
	11.		
	12.		
	13.		
	14.		
	15.		

General Course Policies(授業の進め方)		This course is mainly lectures using slides.
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)		visual, information processing, image understanding
Required Textbooks(教科書)		No textbooks required. Lecture handouts are distributed through LiveCampus.
References/Recommended Reading(参考書)		References will be introduced in the lecture if necessary.
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)	Brain-Inspired Information Processing B		
Instructor Name(担当教員名)	Shuhei IKEMOTO		
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 body is generally a nonlinear object, and the knowledge of nonlinear systems and optimal control is essential to understand the information processing in the brain that controls the motions. In this lecture, we review the mathematical modeling of objects from the basics of analytical mechanics, and review the handling of constraints. After that, we derive the Euler-Lagrange equation, which is the basis of nonlinear optimal control. In addition, by following the derivation of the Euler-Lagrange equations from dynamic programming through the Hamilton-Jacobi-Bellman equations, we learn the basic framework of reinforcement learning and optimal control. In the last part, we derive model predictive control from the theory of nonlinear optimal control and learn its algorithm.		
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. State equation 2. Method of Lagrange multiplier 3. Optimal control in discrete-time systems 4. Calculus of variations 5. Euler-Lagrange equation 6. Numerical solution of E-L equation 7. Hamilton-Jacobi-Bellman equation 8. Model predictive control	
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)	The objective of this lecture is to understand the basic ideas of nonlinear optimal control, and to achieve the following objectives:	
	Couse objectives (具体的な授業の達成目標)	1. Understand the Lagrange's undecided multiplier method. 2. Derive the Euler-Lagrange equation. 3. Understand how to solve Euler-Lagrange equations numerically.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Evaluation will be made on the assignment to be given in each class (60%) and the final exam or report (40%).		
Assignment Instructions (授業外学習(予習・復習)の指示)	(Preparation) Download the materials in advance and prepare for the lecture contents. (Review) Create a notebook that summarizes the lecture contents in your own way and submit it as a report.		
Keywords(キーワード)			
Required Textbooks(教科書)	Nothing		
References/Recommended Reading(参考書)	"古典力学" Goldstein other "非線形最適制御入門" Toshiyuki Otsuka "モデル予測制御—制約のもとでの最適制御" Maciejowski other		
Notes(備考)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explaA basic knowledge of analytical mechanics, modern control theory, and optimal control is required to understand the contents of the class, but since these are explained from the basics, a basic knowledge of physics and mathematics in general is sufficient.		
Email(電子メールアドレス)			

Course Name（科目名）	Behavioral cognitive psychology		
Instructor Name(担当教員名）	Hirohisa Isogai		
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 lecture, we examine the movement of human beings as a behavior rather than just a muscle reaction, and exercise performance as to how a stimulus with a certain mass is presented, maintained, and processed to cause a motor response focus on the inner process of the person. Make understanding of exercise behaviors from cognitive psychological point of view such as information processing of motion, exercise learning, motion control and so on. We also aim to learn motor behavior in social psychology such as motivation, group behavior, interpersonal recognition, group structure etc.		
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. Orientation – MOT seen through OMRON's technological strategy Sensing Technologies 1 –	
	2. Introduction of representative sensors and technology foresight of sensors	
	3. Reaction time and mechanism of decision making	
	4. Evaluation of sports vision	
	5. Attention and performance	
	6. Schema formation and motor learning	
	7. Control of nervous system and exercise	
	8. Mental practice	
	9. Cognitive motivation and exercise behavior	
	10. Interpersonal perception and behavior	
	11. Psychological skills and performance	
	12. Image and Performance	
	13. Function and structure of group	
	14. Presentation of research abstract	
	15. Summary of Behavior Cognitive Psychology	

General Course Policies（授業の進め方）		Lectures will be the main focus, but simple training and psychological measurements will also be included. Summarize academic papers on behavioral cognitive psychology and give a presentation.
Course Objectives（授業の達成目標）	Introduction to Couse Objectives（授業の達成目標の解説）	Deepen cognitive psychological understanding of motor behavior.
	Couse objectives（具体的な授業の達成目標）	1. Understanding motor behavior from the perspectives of motor information processing, motor learning, 2. Understand motor behavior from a social psychological point of view such as motivation, group behavior, interpersonal cognition, and group structure
Evaluation Methods and Ganding Criteria（成績評価の基準および評価方法）		As a general rule, evaluate with a given report (50%), a presentation (30%) for a given task, and a small report (20%) at each lesson.
Assignment Instructions（授業外学習（予習・復習）の指示）		Prepare and submit a report on the subjects indicated at the end of the lecture.
Keywords（キーワード）		
Required Textbooks（教科書）		Introduce as appropriate during the lecture.
References/Recommended Reading（参考書）		Introduce as appropriate during the lecture.
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）		isogai@ip.kyusan-u.ac.jp

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.	Vector and matrix	Elemental oprations of numerical vectors and matrices.
	2.	Matrix product	Matrix product and properties of square matrices.
	3.	Numerical vector space	Linear independence, basis, dimension, rank.
	4.	Linear subspace	Direct sum of vector spaces.
	5.	Determinant	Calculation of determinants and its applications.
	6.	Linear transformation	Linear transformation and matrix representation.
	7.	Linear equations	Solving linear system and the solution space.
	8.	Dual spaces	Dual spaces of covariant and contravariant vectors.
	9.	Determinant	Calculation of determinants and its applications.
	10.	Eignevalue and eigenvector	Concept of eigenvalue and eigenvectors, calculation method.
	11.	Applications of eigenvalue	Application of eigenvalues to sequences, differential equations, etc.
	12.	Inner product and norm	Inner product, norm, complex vectors, Hilbert space
	13.	Quadratic form and optimization problems	Quadratic form, positive-definite symmetric matrices, quadratic opti
	14.	Matrix decompositions	Singular value decompositions, principal component analysis, and ge
	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 Moodle 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)	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)	To have this class, you should take a class, Basic Neuroscience.		

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)		The lecture will be mainly conducted using Power Point. Some lectures will be given remotely (asynchronously). Quizzes will be given during the lectures to check the students' understanding of 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)	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)		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)		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)	To have this class, you should take classes, Basic Neuroscience and Practicum in Neural Information Processing.		

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)		The lecture will be mainly conducted using Power Point. Some lectures will be given remotely (asynchronously). Quizzes will be given during the lectures to check the students' understanding of 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)	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 Hodgikin–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)		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)		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)	Admission to this course will be recommended after taking Basic Neuroscience and Practicum in Neural Information Processing		
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)	In principle, face-to-face class using PowerPoint files will 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 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)	otsubo@brain.kyutech.ac.jp		

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_2021
(2.0 units; Elective Course/Senmon Kamoku)

Instructor: Doosub James Jahng, Ph.D.
Lecture: Thurs 8:50-12:00 (90 min x 16 = 24 hrs.), 2nd Q
Location: Room 7510/ On Line

Course Description:
This course will focus on the use of 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.
Pre-learning is stronly recommended. Students can find the contents of this course on my podcast, DJ Tayori, Street Professor. The episodes on Team Management will have "TMC" in the title, which stands for Team Management Class.

Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)

Learn the fundamentals of being a responsible team member.

Course Calendar/Class Topic (授業計画)

	Theme(テーマ)	Contents(内容)
1.	Learning Tools Guidance	Key Words Meeting (KWM ®), Table Whiteboard, Multiscreen, and KW
2.	System and Management	Definitions and Differences, PDCA Cycle, Relationship with Team
3.	Team	Definition, Descriptions, Communication Hierarchy of Team Communi
4.	Intra-personal Communication	Intra- and Inter-, SWOT Analysis
5.	Leader and Manager	Relationships and Roles in Team
6.	Diversity and Multi-facets	Diversity and Inclusion, Different viewpoint
7.	Soft Skill, Education	World Trends, Informal Education, Educational System
8.	Team Communication Interface	4 Components of TCI and Related Models
9.	Mission Setting	VMOGST, 3 Proposals, 8W3H1S
10.	Information: Presentation	Factors for Sucessible Presentation
11.	WESKT Presentation	How to Prepare for Presentation
12.	Information Relay Model	Informational Path and Human Arrangement
13.	Scheduling	Time Management and Self-Improvement Planning
14	Evaluation	Objectives and Methods
15	Marketing	Basic Concepts of Mk, Survey Design
16	Occupational Health Marketing	Health Resources Management

General Course Policies(授業の進め方)

Versatile educational tools will be used during classes and key word maps will be displayed on multi screens. The learning process will be recorded using Key Words Meeting (KWM®). Feedback will be provided based on students' KWM learning activities and students will be expected to review the feedback before attending the next class.

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 the ability to discuss the following course objectives in their own words.

Couse objectives (具体的な授業の達成目標)

1. Global trends and growing importance of soft skills.
2. The structure of organizational communication hierarchy and related models/theories.
3. Four skills needed for team communication including visualization of evaluation, mission setting and sharing, information sharing, and scheduling.

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 work together with the professor to decide on the percentage breakdown and learning evaluation methods. 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 pre-class preparation, in-class participation and reflection on 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 for class preparation.

Keywords(キーワード)	Team, Communication, Management, Soft skill, Leadeship
Required Textbooks(教科書)	
References/Recommended Reading(参考書)	Doosub Jahng, Three Fundamentals of Efficient Worklife in Team, JISHA, 2003 (Japanese) You Tube, DJ Tayori: Street Professor. 12 episodes on Kizukino Tabi (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 given solely 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 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)	To have this class, you should take a class, Basic Neuroscience.		
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)	[Part 1] To do practices respective themes after lecture using Powerpoint files (in principle, face-to-face class) [part 2] The second part of the course will mainly consist of practices. In principle, face-to-face lectures will be given. Students will be required to submit a report for each week of practice.		
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 typical neuronal models.		
Course Objectives (授業の達成目標) / Couse objectives (具体的な授業の達成目標)	Students should be able to do the following: 1. underdtand the electrophysilogical properties of cells 2. explan voltage dependency of Na and K channles 3. understand the inhibition mechanisms of channel currents 4. underdtand how to investigate the distribution of proteins inside of cells 5. To perform computer simulations of neuron models. 6. To analyze the dynamics of neuronal models. 7. 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) [Part2] Wallisch, P., Lusignan, M., Benayoun, M., Baker, T. I., Dickey, A. S., Hatsopoulos, N. G., MATLAB for Neuroscientists, Elsevier Izhikevich, E. M., Dynamical Systems in Neuroscience, The MIT 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)	otsubo@brain.kyutech.ac.jp; tateno@brain.kyutech.ac.jp

Course Name(科目名)	Intelligent information processing for automobiles		
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)	This special course is arranged for students of Car-Robo-AI Joint Graduate School. Ordinary students can take this course, and the lectures and exercises are given in Japanese.		
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)
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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)		
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)	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)
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	4.		
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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)	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)	Admission to this course will be recommended after taking Basic Neuroscience and Practicum in Neural Information Processing		

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.
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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)	The goals of this course is to improve your understanding of your research interest by considering the relationships between your research and related researches in your division.
	Couse objectives (具体的な授業の達成目標)	Students should be able to do the followings: 1. To understand content of manuscript you presented 2. To be explainable for the manuscript to the persons who have different background knowledge in your 3. To be preparing the understandable handouts 4. To do constructive discussion
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)		human interaction, brain science, neuroscience,
Required Textbooks(教科書)		Research papers and/or textbooks will be provided to students by your supervisor in charge.
References/Recommended Reading(参考書)		References will be provided to students by your supervisor in charge.
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)		otsubo@brain.kyutech.ac.jp

Course Name(科目名)	Machine Learning 1A		
Instructor Name(担当教員名)	Sozo INOUE		
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)	Statistical machine learning is one of the main areas of machine learning and is one of the most important basis. This course deals with probability theory and information theory as the fundation of statistical machine learning		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	In this lecture 1A, we introduce the basics for understandig Bayesian approaches in machine leaning. The central and advanced contents are handled in 1B.		

Course Calendar/Class Topic (授業計画)	Theme(テーマ)	Contents(内容)
	1. Introduction of machine learning	
	2. What is probability theory	
	3. Random variable and its functions	
	4. Multivariate random variable	
	5. Bayes' theorem	
	6. Parameter estimation of probability distribution	
	7. Information theory	
	8. Final examination	
	9.	
	10.	
	11.	
	12.	
	13.	
	14.	
	15.	

General Course Policies(授業の進め方)	It is necessary to take "Fundamental of Mathematics". Students who will take "Machine Learning 1B" need to take this course.	
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)	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)	Preparation: Download the materials in advance, and summerize it to a brief report. Review: Write a brief report about the topics indicated in the class.	
Keywords(キーワード)		
Required Textbooks(教科書)	No text book is needed. Some references are 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)	sozo@brain.kyutech.ac.jp	

Course Name(科目名)	Machine Learning 1B		
Instructor Name(担当教員名)	Sozo INOUE		
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)	Statistical machine learning is one of the main areas of machine learning and is one of the most important basis. This deals with the fundamentals of the statistical machine learning, mainly forcusing on Bayesian approach.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	In machine learning 1B, the central contents of Bayesian approaches for machine learning are introduced, whereas optimization approaches are handled in 2A and 2B.		

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Maximum likelihood and maximum a posteriori estimation	
2.	Bayes' estimation and model selection	
3.	Gaussian process regression and kernel method	
4.	Bayes' inference of exponential family	
5.	Mixture model and EM algorithm	
6.	Variational Bayesian and MCMC	
7.	Topic model	
8.	Final examination	
9.		
10.		
11.		
12.		
13.		
14.		
15.		

General Course Policies(授業の進め方)	It is necessary to take "Fundamental of Mathematics" and "Machine Learning 1A".	
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)	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)	Preparation: Download the materials in advance, and summerize it to a brief report. Review: Write a brief report about the topics indicated in the class.	
Keywords(キーワード)		
Required Textbooks(教科書)	Reference: C.M. Bishop, "Pattern recognition and Machine Learning"	
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)	sozo@brain.kyutech.ac.jp	

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)	To acquire a wide view into human intelligence systems and foster better understanding of academic research, a journal club will be held. The Journal Club runs through both Human Intelligence System 1 and 2. Global AAR course students must take both Human Intelligence System 1 and 2. Other students are also strongly recommended to also take Human Intelligence System 2.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This is a lecture included in the GAAR course.		

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)	All the students must deliver presentations. The number of presentations you give will not change even if you do not take Human Intelligence System 2. Human Intelligence Systems 2 (Tuesday) is the same format as Human Intelligence Systems 1 (Monday). Each course corresponds to 1 credit and participation and successful completion of both the Monday and Tuesday Journal Clubs equals 2 credits.	
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 class is to acquire the skills to conduct meaningful journals in English in other fields, and the following items are the goals to be achieved.
	Couse objectives (具体的な授業の達成目標)	1. Understand how to research treatises 2. Understand the considerations when explaining to researchers in other fields 3. You can find points of contact with presentations in other fields and participate in questions and
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)	Please prepare well before your own presentation. It is recommended to receive his/her supervisor's guidance in selecting introduced paper and preparing slide in order to keep quality of the presentation.	
Keywords(キーワード)		
Required Textbooks(教科書)	No textbook is used. The materials and academic papers to be investigated are selected in consideration of their own fields of specialization and the keywords imposed.	
References/Recommended Reading(参考書)	Nothing	
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 2		
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)	To acquire a wide view into human intelligence systems and foster better understanding of academic research, a journal club will be held. The Journal Club runs through both Human Intelligence System 1 and 2. Global AAR course students must take both Human Intelligence System 1 and 2. Other students are also strongly recommended to also take Human Intelligence System 1.		
Course and Curriculum linkage (カリキュラムにおけるこの授業の位置付け)	This is a lecture included in the GAAR course.		

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)		All the students must deliver presentations. The number of presentations you give will not change even if you do not take Human Intelligence System 2. Human Intelligence Systems 2 (Tuesday) is the same format as Human Intelligence Systems 1 (Monday). Each course corresponds to 1 credit and participation and successful completion of both the Monday and Tuesday Journal Clubs equals 2 credits.
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 class is to acquire the skills to conduct meaningful journals in English in other fields, and the following items are the goals to be achieved.
	Couse objectives (具体的な授業の達成目標)	1. Understand how to research treatises 2. Understand the considerations when explaining to researchers in other fields 3. You can find points of contact with presentations in other fields and participate in questions and
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)		(a) Submission of worksheets every class (40%), (b) Presentation (40%), (c) Discussion (20%)
Assignment Instructions (授業外学習(予習・復習)の指示)		Please prepare well before your own presentation. It is recommended to receive his/her supervisor's guidance in selecting introduced paper and preparing slide in order to keep quality of the presentation.
Keywords(キーワード)		
Required Textbooks(教科書)		No textbook is used. The materials and academic papers to be investigated are selected in consideration of their own fields of specialization and the keywords imposed.
References/Recommended Reading(参考書)		Nothing
Notes(備考)		Usually lectures are given in English.
Email(電子メールアドレス)		

Course Name(科目名)	Neuronal mechanism for human sensory transduction		
Instructor Name(担当教員名)	Hidemasa FURUE		
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 will summarize how sensory information is processed in higher organisms including humans, and have a discussion on its physiological roles. How sensory information, in particular, somatic sensation is modified and controlled in the central nervous system in a highly precise and dynamic manner, and plastic changes in the sensory transduction in some situations are introduced. Recent electrophysiological and neuroscientific methods for detecting neuronal and synaptic signals such as in vivo patch-clamp techniques and optogenetic approaches will be also explained. The principles and basic concepts shown in this lecture would be helpful for general understanding of sensory transduction and critical reading of the scientific		
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.	Sensory information and its signal tra	
	2.	Somatosensory pathways	
	3.	Sensory receptor and ion channel	
	4.	Neuronal excitation and its propagati	
	5.	Synapse	
	6.	Synaptic transduction mechanism fo	
	7.	Electrophysiological recording techni	
	8.	Recordings of action potential and sy	
	9.	Analysis of synaptic responses elicit	
	10.	Slice patch-clamp recording techniq	
	11.	In vivo patch-clamp recording techn	
	12.	Optogenetics and neuronal excitatio	
	13.	Central modulation of sensory inform	
	14.	Sensory transduction in pathological	
	15.	Plastic changes in sensory transduct	
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)	In order to understand how living organisms such as humans process sensory information and what kind of physiological role it has, the following are the goals to be achieved.	
	Couse objectives (具体的な授業の達成目標)	1. Explain the mechanism and characteristics of living organisms such as humans to process sensory information, and their physiological roles. 2. Explain the central control and modification of sensory communication in relation to the basic physiological characteristics of neurons. 3. Explain the increase and decrease of sensory transmission in the mental state by giving an example. 4. You can list the neurophysiological methods for recording sensory information, the methods for manipulating neural circuits, and their principles.	
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	will be based on attendance and active perception (50%) and written reports (50%)		
Assignment Instructions (授業外学習(予習・復習)の指示)	Learning the topics in particular technical terms listed above before taking, and reviewing main points shown in handouts given at this lecture are strongly recommended. Written reports should be submitted by the standard deadline.		
Keywords(キーワード)			
Required Textbooks(教科書)	Textbooks and references will be introduced at the lecture.		
References/Recommended Reading(参考書)			
Notes(備考)	This lecture will be conducted in Japanese. But if attendants need, lecturer will provide simultaneous translation service to English.		
Email(電子メールアドレス)			

Course Name（科目名）	Laboratory Animal Science		
Instructor Name(担当教員名）	Eiji SAGARA, DVM, MS, Ph.D.		
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）	Laboratory animal science is an academic field that comprehensively deals with areas related to experimental animals. The purpose of this course is to learn about the necessity of animal experiments, relevant laws and regulations of animal experiments, ethics and animal welfare of animal experiments. In addition, we also learn how to carry out highly reproducible animal experiments and how to carry out safe animal experiments. Many engineering technologies are used for environmental control necessary for highly reproducible animal experiments, and the lecture also introduces the contents. Based on the basic knowledge of laboratory animal science, students learn reproductive engineering, genetic recombination technology, genome editing, etc. By doing so, we aim to acquire a higher level of laboratory animal science, which is indispensable for most-advanced medical research.		
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 desirable to take this course when conducting research using laboratory animals.		
Course Calendar/Class Topic （授業計画）		Theme(テーマ)	Contents（内容）
	1.	Overview of Laboratory Animal Scier	Medical research, extrapolation, genome, in vivo, in vitro
	2.	Regulations and guidelines of the rel	Act on Welfare and Management of Animals, etc.
	3.	Ethics of animal experimentation	3Rs, 5Fs, pain degree classification (SCAW), humane endpoint, etc.)
	4.	Animal welfare	Relief of pain, environmental enrichment, wellbeing, alternative meth
	5.	Care and management of the experir	Feed, drinking water, cages, bedding, ILAR Guide
	6.	Laboratory animals and the environm	Environment control, engineering control, temperature and humidity
	7.	Types and their characteristics of th	Mice, rats, hamsters, guinea pigs, rabbits, dogs, cats,etc.
	8.	Comparative biology	Anatomy, physiology, metabolism and nutrition, clinical application, s
	9.	Disease model animals	Spontaneous animal, genetically modified animals, genome editing, e
	10.	Infectious diseases and its preventic	Disinfection and sterilization, microbial monitoring, epidemiology, virt
	11.	Prevention of zoonoses	Hemorrhagic fever with renal syndrome, lymphocytic choriomeningit
	12.	Laboratory animal allergy	Allergen, immediate hypersensitivity, sensitization, asthma, anaphyla
	13.	Laboratory animals and development	Embryo freezing, sperm freezing, in vitro fertilization, genome editin
	14.	Experimental animal technology	Appropriate anesthesia, appropriate euthanasia, accurate handling, a
	15.	Advanced medical research and exp	The iPS cells, regenerative medicine, genomic medicine, severe imm
General Course Policies（授業の進め方）	At the lecture of the Laboratory Animal Science, technical words associated with medicine, veterinary medicine and biology is used. When you do not learn biology at a high school or a university, enough preparations for lectures are necessary. The attendance rate in the class will be evaluated.		
Course Objectives（授業の達成目標）	Introduction to Couse Objectives（授業の達成目標の解説）	In this class, we aim to achieve the following three goals.	
	Couse objectives（具体的な授業の達成目標）	1. Understand the laws and regulations related to experimental animals such as the "Act on Welfare and 2. Understand the characteristics of each laboratory animal and the essential items related to its use, 3. Understand the contents of advanced science research papers using genetically modified animals and	
Evaluation Methods and Ganding Criteria （成績評価の基準および評価方法）	Grades are assessed by attendance, expected preparation and review, and assignment reports. Problems in the assignment report are announced during class.		
Assignment Instructions （授業外学習（予習・復習）の指示）	Please prepare based on the keywords listed in the lesson plan. And preparation for the lecture, be submitted together in a report. If you are not familiar with the terms medical and biological, you should read the text of laboratory animal science.		
Keywords（キーワード）	laboratory animals, animal welfare, ethics of animal experimentation, comparative biology, genetic engineering, safety		
Required Textbooks（教科書）	Laboratory Animal Science, edited by Shigeru Kyuwa. Asakura Publishing Co.,Ltd. 2013. ISBN978-4-254-46031-5 C3061 http://www.jalas.jp/gakkai/kanren_safety.html http://www.kokudoukyou.org/index.php?page=kisoku_index		
References/Recommended Reading（参考書）	Not used in particular.		
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）	sagara@hyo-med.ac.jp		

Course Name(科目名)	Large-Scale Neural Network Simulation		
Instructor Name(担当教員名)	Jun Igarashi		
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 brain performs information processing by interactions of signals through synaptic connections among vast numbers of neurons. To investigate the mechanism of function and disease in the brain, large-scale simulations of realistic neural network models of the brain has been actively conducted recently. In this lecture, we will learn basic knowledge and ways to perform large-scale simulations of neural networks. First, we will learn the feature and significance of large-scale simulations of neural networks. Next, from viewpoints of performing large-scale neural networks, we will lean neurophysiology, modeling of neural networks, numerical calculation methods, mechanism of computers, and parallel computing. Finally, we will see representative case examples of large-scale simulation of neural networks and consider the future direction.		
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: What is large-scale neural network simulation?	
	2.	Basics of neuroscience1	
	3.	Basics of neuroscience2	
	4.	Conputing environment for large-scale neural network simulation	
	5.	Neural network modeling1	
	6.	Neural network modeling2	
	7.	Numerical calculation methods	
	8.	Python programming	
	9.	Mechanism of computers	
	10.	Introduction to parallel computing	
	11.	Large-scale neural network programming1	
	12.	Large-scale neural network programming2	
	13.	Introduction of large-scale neural network simulations	
	14.	Futureof large-scale neural network simulations	
	15.	Examination	
General Course Policies(授業の進め方)	We recommend to take lectures of Basic neuroscience, Information Processing using Brain Dynamical System, Mathematical neurophysiology before taking this lecture.		
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 to be achieved are as follows.	
	Couse objectives (具体的な授業の達成目標)	1. To understand the mechanism and mathematical model of action potential generation in neurons. 2. To understand the parallel computing mechanism of modern computers and parallel computing models. 3. To understand how to simulate large-scale neural circuit models using parallel computation and how to	
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, mini-examination, and final examination.		
Assignment Instructions (授業外学習(予習・復習)の指示)	Students are expected to review what you leaned in the lecture for final examination on the last day.		
Keywords(キーワード)	The Brain、Neurons, Neural Networks, Computational Science, Computational Neuroscience.		
Required Textbooks(教科書)	We will not use textbooks. Rreference books are as follows, Mark F. Bear, Neuroscience: Exploring theBrain, Lippincott Williams & Wikins, 2006, John G. Nicholls, From Neuron to Brain, Sinauer, 2012 Peter S. Pacheco, Parallel programming with MPI, Morgan Kaufmann, 1996 Hatsuo Hayashi, Nonlinear phenomenonin neural systems, Coronasha, 1998 Hayato Togawa, Numerical calculation methods, Coronasha, 1981 Takahiro Katagiri, Introduction to supercomputer programming, University of Tokyo Press, 2013 David A. Patterson, Computer organization and design, Morgan Kaufmann, 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)	jigarashi@riken.jp		

Course Name(科目名)	Psychophysiology		
Instructor Name(担当教員名)	Shigeyuki Kan		
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)	This course introduces several fundamental measurement techniques that are used in psychophysiological research and practical examples of using them.		
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 basic knowledge to perform researches in the field of life science and systems engineering, in particular, cognitive psychology/neuroscience.		

Course Calendar/Class Topic
(授業計画)

	Theme(テーマ)	Contents(内容)
1.	Introduction	Overview of Psychophysiology
2.	Cardiocirculatory activity (1)	Measurement and analysis of electrocardiogram (ECG)
3.	Cardiocirculatory activity (2) Respiratory activity	Measurement and analysis of blood pressure, pulse wave, respiration, and skin temperature
4.	Electrodermal activity	Measurement and analysis of electrodermal activity (EDA)
5.	Muscle activity and skin sympathetic nerve activity	Measurement and analysis of electromyogram (EMG) and microneurogram
6.	Immune/endocrine system	Measurement and analysis of biochemical indicators
7.	Eye movement, eye blink, pupil response	Measurement and analysis of eye movement, eye blink, and pupil rea
8.	Brain activity (1)	Measurement and analysis of electro- (EEG) and magnetoencephalogram (MEG)
9.	Brain activity (2)	Measurement and analysis of positron emission tomography (PET), functional MRI (fMRI), and functional near-infrared spectroscopy
10.	Transcranial magnetic/electrical stimulation	Investigation methods for brain function using transcranial magnetic/electrical stimulation (TMS/tES)
11.	Biofeedback/Neurofeedback	Self-regulation methods of brain activity with non-invasive brain measurements
12.	Experimental design of psychophysiological research (1)	Explanation of actual psychophysiological experiments
13.	Experimental design of psychophysiological research (2)	Explanation of actual psychophysiological experiments
14.	Demonstration of psychophysiological measurement (1)	Demonstration of psychophysiological measurements
15.	Demonstration of psychophysiological measurement (2)	Demonstration of psychophysiological measurements

General Course Policies(授業の進め方)	Usually, lectures are given by using presentation software. In fourteenth and fifteenth lecture, there is a practice of psychophysiological measurement. In each lecture, a handout is provided. During the course, mini-exams are made three times. After all lectures, there is a reporting assignment.	
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 course is that students obtain basic knowledge about psychophysiology and neuroscience.
	Couse objectives (具体的な授業の達成目標)	1. Students can understand the fundamental methodologies for psychophysiological research. 2. Students can read and explain research papers of psychophysiology by themselves. 3. Students can select appropriate psychophysiological measures for the purpose of research.
Evaluation Methods and Ganding Criteria (成績評価の基準および評価方法)	Grades are evaluated based on a report (60%), mini-exams (30%), and learning attitudes (10%).	
Assignment Instructions (授業外学習(予習・復習)の指示)	Before the thirteenth lecture, students are required to read designated research papers. After the fifteenth lecture, students are required to submit a report by the due date. The theme of the report and the due date are told at the fifteenth lecture.	
Keywords(キーワード)	autonomic activity, brain activity, brain stimulation/modulation, cognitive psychology, neuroscience	
Required Textbooks(教科書)	A textbook is not used.	
References/Recommended Reading(参考書)	(1) Psychophysiology: Human Behavior & Physiological Response, John L. Andreassi, Psychology Press (2) Principles of Neural Science, Fifth Edition, McGraw-Hill	
Notes(備考)	Lectures are given in Japanese. However, if there are students who need explanations in English, I provide them handouts written in English, and they can use English to write a report and take mini-exams.	
Email(電子メールアドレス)	kan-jscn@umin.net	

Course Name(科目名)	Brain Inspired Artificial Intelligence		
Instructor Name(担当教員名)	Motoaki Kawanabe, Eiji Uchibe, Tomoyasu Horikawa		
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 aims to provide an outline of brain-inspired artificial intelligence that tries to understand the mechanisms of the brain and implement brain models into artificial systems. At first, we show the basics of decision making theories such as optimal control and reinforcement learning, and then, we give an overview of deep learning and deep reinforcement learning that has been receiving attention recently. Finally, we introduce machine learning methods and their applications to neuroimaging, brain machine interface, and neurofeedback.		
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 to decision making theo	
	2. Bandit problem	
	3. Reinforcement learning (1): value-ba	
	4. Reinforcement learning (2): policy se	
	5. Reinforcement learning (3): inverse r	
	6. Deep learning (1)	
	7. Deep learning (2)	
	8. Deep reinforcement learning (1)	
	9. Deep reinforcement learning (2)	
	10. Evolutionary computation	
	11. Neuroimaging	
	12. Brain machine interface	
	13. Machine learning for neural decoding	
	14. Machine learning for neural decoding	
	15. Neurofeedback	

General Course Policies(授業の進め方)	Report submission is required because course content is given in lectures.	
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)	Students are assessed according to their performance on the course report.	
Assignment Instructions (授業外学習(予習・復習)の指示)	Reading handouts in advance and preparing a report after the lectures.	
Keywords(キーワード)		
Required Textbooks(教科書)	No textbook	
References/Recommended Reading(参考書)		
Notes(備考)	Lecture is conducted in Japanese. If a student desires a lecture in English, this may be arranged on an individual basis.	
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