Course Title（科目名）	Society and Technology		
Lecturer（担当教員）	Kouichi Nakano		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	Some of the most important things for the people who will lead the future technology are to make a contribution to the human happiness and to feel strongly about professional job consciousness. When we develop a new technology, engineer should seek a solution to a problem and should give careful attention to the trends of public opinion for the technology. It is important to consider the various social problems including an environmental problem and an energy problem from the point of view on the correlation between technology and society. In this lecture, first of all, we consider why the engineers responsibility and morals are inquired returning to the fundamentals. Next, we explain about engineering strategy of companies, management sense, and legal knowledge for engineers. Material engineering from the past to the future, the relation between microbes and man in the social environment, the joining and welding technology between some materials, and the current construction technology are also explained.		
Topics/Schedule（授業計画）	1 Engineers morals (The engineers responsibility in the conpanies (1) 2 Engineers morals (The engineers responsibility in the conpanies (2) 3 Engineers morals (The engineers responsibility in the conpanies (3) 4 Engineering strategy of companies and management sense for engineers (1) 5 Engineering strategy of companies and management sense for engineers (2) 6 Legal knowledge for engineers (1) 7 Legal knowledge for engineers (2) 8 Material engineering from the past to the future (1) 9 Material engineering from the past to the future (2) 10 The relation between microbes and man in the social environment (1) 11 The relation between microbes and man in the social environment (2) 12 The joining and welding technology between some materials (1) 13 The joining and welding technology between some materials (2) 14 The current construction technology (1) 15 The current construction technology (2)		
Evaluation/Grading Policy（成績評価方法）	Basically, the evaluation by the reports for the given theme and the attendance rate is executed.		
Remarks（履修上の注意）	Nothing		
Expected preparation and review（授業外学習（予習・復習）の指示）	Downloading a handout and reading through it once is required. You must submit the reports for the theme indicated at the end of class.		
Textbooks, References（教科書・参考書・資料）	The textbooks are not used. The reference books are shown below. (1) Murakami, Basis of modern engineering − History of engineering −, Iwanami, 2001 (in Japanese) (2) The institution of professionsl engineers,Japan, The morals of scientific technicians − its way of thinking and examples −, Maruzen, 1998 (in Japanese) (3) a Compendium of Laws (in Japanese) The materials for the class are distributed during class.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Introduction to Green Technology		
Lecturer（担当教員）	Prof. Kato, Prof.Abe, Prof.Hayase, Prof.Nishida		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	Green Technology which is technology 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.		
Topics/Schedule（授業計画）	1. Outlook of Bioplastics 2. Basic Functions and Applications of Bioplastics 3. Bioplastics and Recycling 4. Bioplastics and Sustainability 5. History of Switched Mode of Power Supply(SMPS) 6. Circuit of SMPS 7. Control of SMPS 8. Power Supply System and SMPS 9. Outlook of Solar Cell 10. Printable Solar Cell 11. Solar Cell Application for Green Technology 12. Outlook of Fuel Cell 13. Current situation and perspectives on the Energy use 14. Solid Oxide Fuel Cell Technology 15. Hydrogen Production Technology and High Temperature Steam Electrolysis 16. Energy technology for zero-emission		
Evaluation/Grading Policy（成績評価方法）	Grading will be decided based on attendance, and reports to each lectureres.		
Remarks（履修上の注意）	Strongly recommended for attendance of students who belongs to Dept of Biological Funtions Engineering. Mind the schedule to be announced.		
Expected preparation and review（授業外学習（予習・復習）の指示）	It is recommended to visit each lectures website to know the area of research beforehand. Searching books or website relating to topics of each lectures will be helpful for your better understanding.		
Textbooks, References（教科書・参考書・資料）	Will be introduced in the class.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Life Science and Systems Engineering Seminar Series		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	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		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of reports.		
Remarks（履修上の注意）	None		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Textbooks and references will be not used.		
Language（使用言語）	tures are given in Japanese. However the teacher will explain individually to those students who need explanation		

Course Title（科目名）	Introduction to Human Intelligence Systems		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1～6. (1) Basic knowledge, latest research topics, test of Human Intelligence and Machines Division 7～11. (2) Basic knowledge, latest research topics, test of Intelligence Systems and Emergent Design Division 12～16. (3) Basic knowledge, latest research topics, test of Human Interaction and Brain Functions Division		
Evaluation/Grading Policy（成績評価方法）	Evaluation will be done by the summation of tests.		
Remarks（履修上の注意）			
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Will be lectured in the course.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

科目名(Course Title)	日本語入門(Introductory Japanese)		
担当教員(Lecturer)	石川　朋子(ISHIKAWA Tomoko)		
開講年次(Year)	1年次(First Year)		
単位区分(Credit Category)	選択(Option)	単位数(Credits)	1単位
目的・概要 (Course Objectives/Outlines)	To get used to Japanese phoneme system. To master basic Japanese sentence patterns and vocabularies. To be able to use greeting expressions and speak simple Japanese. To master Hiragana and Katakana.		
授業計画 (Topics/Schedule)	1. Basic greeting expressions and self introduction 2. Counting system, time-measuring system 3. Sentences using nouns 4. Numerals and counter words in Japanese 5. Shopping conversation 6. Sentences to express existence 7. Expressions of dates and periods of time 8. Introduction of basic verbs 9. Sentences using basic verbs (non-past) 10. Sentences using basic verbs (past) 11. Conversation using basic verbs 12. Two types of adjectives and their usage 13. Basic verb conjugation 14. Review 15. Written test 16. Oral test		
成績評価方法 (Evaluation/Grading Policy)	Class participation, assignments, written and oral tests.		
履修上の注意 (Remarks)	We will use a romanized Japanese textbook and concentrate on developing the basic hearing and speaking abilities required in daily life. You can enter the CLASS 2 at FAIS after this course when your Japanese is sufficient for the class. ※International students only		
授業外学習 (予習・復習)の指示 (Expected preparation and review)	Do every assignment.		
教科書・参考書・資料 (Textbook, References)	1. *Beginner's Japanese for KIT Foreign Students* 2. *Exercise Book of Beginner's Japanese for KIT Students* 3. *Nihongo Kiite Hanashite (The Japan Times)*		
使用言語 (Language)	Japanese. English, if necessary.		

Course Title（科目名）	International Internship		
Lecturer（担当教員）	Professor in charge of International Internship		
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 Objectives/Outlines（目的・概要）	In order to foster the ability to communicate in a foreign language and acquire a global perspective which are required to become global engineers, students will engage in engineering internship at overseas universities, research institutes, or companies.		
Topics/Schedule（授業計画）	Students must engage in internship at overseas universities, research institutes, or companies for 60 hours or longer in total, and submit a report of the internship activities after completing the internship. An alternative reporting assignment may be given to students from overseas who cannot engage in engineering internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase overseas travelers' personal accident insurance and Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services). They should assess local culture and customs of countries where they will be staying. They should check the website for overseas safety of MOFA (Ministry of Foreign Affairs of Japan), and fully confirm the information for local safety risks of theft, infection, etc.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should prepare to introduce themselves and explain their research contents in English. They should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internships, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	English will be used.		

Course Title（科目名）	Domestic Internship 1		
Lecturer（担当教員）	Professor in charge of Domestic Internship		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	In order to acquire the practical skills to logically analyze and solve engineering problems, and to understand the role engineers play in society, students will engage in internship at domestic companies, research institutes, or universities (other than Kyutech).		
Topics/Schedule（授業計画）	Students must engage in engineering internship at domestic companies, research institutes, or universities (other than Kyutech) for 30 hours or longer in total, and submit a report of the internship activities after completing the internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services). Those who engage in internships at two or more organizations can get credit for this course if the total internship time is 30 hours or longer. Those who get credit for this course cannot get credit for Domestic Internship 2.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internship, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	Language depends on organizations where students engage in internship.		

Course Title（科目名）	Domestic Internship 2		
Lecturer（担当教員）	Professor in charge of Domestic Internship		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	In order to acquire the practical skills to logically analyze and solve engineering problems, and to understand the role engineers play in society, students will engage in internship at domestic companies, research institutes, or universities (other than Kyutech).		
Topics/Schedule（授業計画）	Students must engage in engineering internship at domestic companies, research institutes, or universities (other than Kyutech) for 60 hours or longer in total, and submit a report of the internship activities after completing the internship. An alternative reporting assignment may be given to adult students who cannot engage in internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services). Those who engage in internships at two or more organizations can get credit for this course if the total internship time is 60 hours or longer. Those who get credit for this course cannot get credit for Domestic Internship 1.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internship, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	Language depends on organizations where students engage in internship.		

Course Title（科目名）	DEGEIKO Program 3, 4		
Lecturer（担当教員）	Professor in charge of DEGEIKO program		
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 Objectives/Outlines（目的・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.		
Term（実施形態・期間）	Short term: basic level, DEGEIKO program 3, 1 credit, 1.5 month Long term: basic level, both DEGEIKO program 3 and 4, 2 credits, 3 months		
Topics/Schedule（授業計画）	See the DEGEIKO program's guidance or ask your supervisor.		
Evaluation/Grading Policy（成績評価方法）	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.		
Remarks（履修上の注意）	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.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Textbooks and references will be assigned by a supervisor of the away laboratory.		
Language（使用言語）	ctures are given in Japanese. However we will have lecture in English if there are students who need explanation		

Course Title（科目名）	DEGEIKO Program 1, 2		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Term（実施形態・期間）	Short term: basic level, DEGEIKO program 1, 1 credit, 1.5 month Long term: basic level, both DEGEIKO program 1 and 2, 2 credits, 3 months		
Topics/Schedule（授業計画）	See the DEGEIKO program's guidance or ask your supervisor.		
Evaluation/Grading Policy（成績評価方法）	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.		
Remarks（履修上の注意）	Master's students can take DEGEIKO program 1 and 2 during different times and earn 2 credits in total.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Textbooks and References will be assigned by a supervisor of the away laboratory.		
Language（使用言語）	ctures are given in Japanese. However we will have lecture in English if there are students who need explanation		

Course Title（科目名）	Advanced Human Intelligence systems 3		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1–7. Reading exercises to improve reading skills for research papers and related academic textbooks of the Division of Human Interaction and Brain Functions. 8. Exam – Oral presentation in the presence of the professors of the division.		
Evaluation/Grading Policy（成績評価方法）	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.		
Remarks（履修上の注意）	Admission to this course will be decided by conferring with a supervisor.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Research papers and/or textbooks will be provided to students by a teacher in charge.		
Language（使用言語）	This course will be taught in Japanese. Oral presentations and discussion can be conducted in English if a student wishes to do so.		

Course Title（科目名）	Advanced Human Intelligence Systems 2		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	This course aims at acquiring a latest and wide view into human intelligence systems and foster better understanding of academic research. All the students introduce a high-quality jounal paper each other.		
Topics/Schedule（授業計画）	1-8. Presentation and Discussion		
Evaluation/Grading Policy（成績評価方法）	(a) Submission of worksheets every class (40%), (b) Presentation (40%), (c) Discussion (20%)		
Remarks（履修上の注意）	Each student must receive his/her supervisor's guidance in selecting introduced paper and preparing slide in order to keep quality of the presentation.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Investigate keywords and technical terms which you cannot understand on the presentations.		
Textbooks, References（教科書・参考書・資料）	None		
Language（使用言語）	Usually lectures are given in English.		

Course Title(科目名)	Advanced Human Intelligence Systems 1		
Lecturer(担当教員)	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 Objectives/Outlines (目的・概要)	This course aims at acquiring a latest and wide view into human intelligence systems and foster better understanding of academic research. All the students introduce a high-quality jounal paper each other.		
Topics/Schedule (授業計画)	1-8. Presentation and Discussion		
Evaluation/Grading Policy (成績評価方法)	Submission of worksheets every class (40%), Presentation (40%), Discussion (20%)		
Remarks (履修上の注意)	Each student must receive his/her supervisor's guidance in selecting introduced paper and preparing slide in order to keep quality of the presentation.		
Expected preparation and review (授業外学習(予習・復習)の指示)	Investigate keywords and technical terms which you cannot understand on the presentations.		
Textbooks, References (教科書・参考書・資料)	None		
Language (使用言語)	Usually lectures are given in English.		

Course Title（科目名）	Interdisciplinary Practice 1, 2		
Lecturer（担当教員）	Professor in charge of International Awareness Internship		
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 Objectives/Outlines（目的・概要）	By solving problems related (1) English language and (2) interdisciplinary research topics, it is expected to master international skills and obtain the ability to respond to different research fields at the worldwide level as well as domestic level.		
Topics/Schedule（授業計画）	As this course is conducted on OJT (On-the-Job Training), the schedule differs from case to case. For example, you can practice the English learning program necessary for research work by individual or group, the research program in a different field from your own field of research at laboratories or centers outside your laboratory, and the collaborative research program at overseas laboratories. · Make plan and carry out PBL (Project-Based Learning) in English. · Practice advanced research work in different fields at laboratories outside your laboratory or centers in the university. · Stay at overseas universities such as the universities with MOU for about one month, and conduct collaborative international research work. · Plan and carry out the interdisciplinary project for solving problem.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be evaluated by the quality of report.		
Remarks（履修上の注意）	In order to take Interdisciplinary Practice 2, it is necessary to take Interdisciplinary Practice 1		
Expected preparation and review（授業外学習（予習・復習）の指示）	Before this course, research contents should be surveyed by papers, internet or other methods to obtain necessary knowledge and related technology. During period of this course, (1) in case of the domestic and overseas research work, study should be conducted in the laboratory of the visiting institution while receiving instruction from the co-supervisor in order to obtain knowledge of different fields, (2) in case of the interdisciplinary project for solving problem, preparation should be conducted while receiving instructions from the project supervisor.		
Textbooks, References（教科書・参考書・資料）	Textbooks are not be specified, but reference books may be suggested. Materials may be distributed.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Interactive Seminar		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1-8. Mid-term presentation, Submission of a report on mid-term presentation, Listen to oral research presentations		
Evaluation/Grading Policy（成績評価方法）	(a) Mid-term presentation, (b) Submission of a report, (c) Listen to oral research presentations		
Remarks（履修上の注意）	Students must conduct mid-term presentation, submission of a report, and listen to oral research presentations according to supervisors' guidance.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Supervisors will instruct students to prepare and review.		
Textbooks, References（教科書・参考書・資料）	Textbooks and references will be assigned by supervisors.		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	AI Seminar		
Lecturer（担当教員）	Hakaru Tamukoh		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	In this course, students will study about recent key topics of artificial intelligence through lectures and practices. Learning sytems with programming in deep learning frameworks and GPU machines will be introduced to understand about basic deep neural networks, generative models and reinforcement learning.		
Topics/Schedule（授業計画）	1 Feedforward networks 2 Feedforward networks 3 Regularization for deep learning 4 Regularization for deep learning 5 Optimization for traning deep models 6 Optimization for traning deep models 7 Convolutional networks 8 Convolutional networks 9 Recurrent networks 10 Recurrent networks 11 Autoencoders 12 Autoencoders 13 Generative models 14 Generative models 15 Reinforcement learning 16 Reinforcement learning		
Evaluation/Grading Policy（成績評価方法）	Your overall grade in the class is decided based on the followings: weekly report (50%) and examination (50%).		
Remarks（履修上の注意）	Students are expected to have learned basics of programming.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Study the meaning of unknown technical term as preparation for the next lecture. After the class, list the keywords and investigate the research related to that keywords in books or search engine for academic texts.		
Textbooks, References（教科書・参考書・資料）	Ian Goodfellow, Yoshua Bengio, Aaron Courville, ″Deep Learning″, MIT Press, 2016.		
Language（使用言語）	tures are given in Japanese. However the teacher will explain individually to those students who need explanation		

Course Title（科目名）	Neuronal mechanism for human sensory transduction		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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 literatures.		
Topics/Schedule（授業計画）	1 Sensory information and its signal transduction mechanism and physiological role 2 Somatosensory pathways 3 Sensory receptor and ion channel 4 Neuronal excitation and its propagation 5 Synapse 6 Synaptic transduction mechanism for sensory information 7 Electrophysiological recording techniques 8 Recordings of action potential and synaptic responses 9 Analysis of synaptic responses elicited by sensory stimulation 10 Slice patch-clamp recording technique 11 In vivo patch-clamp recording technique 12 Optogenetics and neuronal excitation by light stimulation 13 Central modulation of sensory information 14 Sensory transduction in pathological states 15 Plastic changes in sensory transduction		
Evaluation/Grading Policy（成績評価方法）	will be based on attendance and active perception (50%) and written reports (50%)		
Remarks（履修上の注意）			
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Textbooks and references will be introduced at the lecture.		
Language（使用言語）	This lecture will be conducted in Japanese. But if attendants need, lecturer will provide simultaneous translation service to English.		

Course Title（科目名）	Vision Sensing and Systems Intelligence Engineering		
Lecturer（担当教員）	Masaki Suwa and Hiroshi Nakajima		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	The class includes about the basic method of algorithm development of and application studies on intelligent systems. The study aims creating the ideas used in problem solving approach and communication between human s and machines based on intelligence extracted and learned from human and nature. The essential goal of the study is to create various types of values such as for society, technology, and science. The contents are as follows; sensing, signal processing, statistics, fuzzy logic, and soft computing. Besides their basics, apllication studies of healthcare, mobility, and manufacturing. Especially, sensing design and causal analysis will be focused on.		
Topics/Schedule（授業計画）	1. Orientation – MOT seen through OMRON's technological strategy 2. Sensing Technologies 1 – Introduction of representative sensors and technology foresight of sensors 3. Sensing Technologies 2 – What is the difference between "sensor" and "sensing"? 4. Sensing Technologies 3 – Technology foresight of sensing based on recent progress of sensors Modeling method for sensing – Mathematical approaches for mnodeling 5. keywords: orthgonal expansion of sensor data, state space representation, Bayesian approach, pattern recognition 6. Practices of modeling for sensing 1 – state-of-the-art vision sensing technologies 7. Practices of modeling for sensing 2 – Which has more important role in modeling for sensing, human or ma 8. ・Sensing and AI technologies – How AI technologies can contribute to the progress of sensing technologies, and vice versa? ・Epilogue – Consideration on what the R&D in Japanese company is. 9. Orientation – Abstract of Systems Intelligence. The goal and expeced effects of the technology are covered. The importance of problem definition is deeply discussed. 10. Human Intelligence – Knoledge and infrence are studied based on the expert systems, fuzzy sets, fuzzy inference. The many applications of the intelilgence will be introduced. 11. Data Intelligence (1) – The basics of statistics will be covered. Essentialn technology for knowledge discovery and algorithm development method are introduced. 12. Data Intelligence (2) – As the application of data intelligence, healthcare and medical data analysis and their algorithm delovepments will be introduce and discussed. 13. Social Intelligence and Agents (1) – The model of human and machine interaction will be investigated. The mind model is introduced and discussed to realize autonomy and emotion expression of the machine side. 14. Social Intelligence and Agents (2) – As the application studies of social intelligence, software agents, pet robot, and coraborative leaning agents will be introduced. 15. Nature Intelligence and Intelligence Integration – As intelligence learnt from nature, neural network and genetic algorithms will be briefly introduced. Intelligence integration among different intelligence studied in the class will be discussed with application studies.		
Evaluation/Grading Policy（成績評価方法）	Evaluation by mini-examination in the class and report assignments.		
Remarks（履修上の注意）	Nothing special		
Expected preparation and review（授業外学習（予習・復習）の指示）	Submissions of the report to the assignmens at the final class will be required.		
Textbooks, References（教科書・参考書・資料）	No text book will be used in the class. The materials will be delivered at each class and the reference will also be introduced if necessary.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Measurement of Human Brain Function		
Lecturer（担当教員）	Hiroaki Mizuhara		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	Studies on the human brain function (e.g., language processing, communication, etc) are called "cognitive neuroscience." It is generally done with non-invasive brain imaging techniques. The lecture is for the introduction on these techniques in the field of the cognitive neuroscience. Actual examples will be also introduced in the lecture to understand how to use the brain imaging techniques to measure human brain function.		
Topics/Schedule（授業計画）	1 What is the "cognitive" neuroscience? 2 Basics of the brain structures -anatomy and physiology 3 Recordings of electric features of brain -EEG & MEG 4 Brain imaging -PET & fMRI 5 Investigation of brain causality -lesion studies & TMS 6 Examples of human brain recordings		
Evaluation/Grading Policy（成績評価方法）	Evaluate with technical reports/ short essays.		
Remarks（履修上の注意）	Learn basics of neuroscience prior to the lecture.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Download and read resumes prior to the lecture. Learn keywords on this syllabus prior to the lecture. Submit homework (technical report/ short essay) after the lecture.		
Textbooks, References（教科書・参考書・資料）	Reference: Ward, J. "The Student's Guide to Cognitive Neuroscience -2nd Edition-", Psychology Press (2010) Other references or papers may be introduced during the lecture.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Psychophysiology		
Lecturer（担当教員）	Satoru Miyauchi Ph.D.		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	The purpose of this class is to gain basic knowledge about neuroscience and psychophysiology.		
Topics/Schedule（授業計画）	The following issues will be lectured: 1 Basic research and application research in the field of neuroscience 2 Eye movements during sleep and its relationship with dreaming 3 Non-invasive measurements of human brain activity (fMRI, EEG, MEG, NIRS, TMS, and so on) 4 Explanation about basic academic terms in the field of neuroscience and psychology 5 Explanation about the structure and function of the human brain		
Evaluation/Grading Policy（成績評価方法）	All students who take the class will be required to submit a report about instructed topics by mail (Japanese or English). Both the report and discussion in the class will be evaluated.		
Remarks（履修上の注意）	Each student will be requied to bring a Windows laptop PC to view MR images of the human brain, but not indispensable.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Reading the reference 1 in advance makes it easy to understand the lectue. It can be downloaded from the following address: http://www2.nict.go.jp/advanced_ict/plan/s-brain/miyauchi/index.html		
Textbooks, References（教科書・参考書・資料）	No textbook. References: (1) Non-invasive study of human brain function and psychophysiology (2nd edition) 脳を測る －改訂 ヒトの脳機能の非侵襲的測定－ 心理学評論56(3): 414-454, 2013 (2) Kandel et al., Principles of Neural Science, Fifth Edition, McGraw-Hill, ISBN 978-07-139011-8		
Language（使用言語）	ctures are given in Japanese. However we will have lecture in English if there are students who need explanation		

Course Title（科目名）	Visuomotor Control System		
Lecturer（担当教員）	Makoto Kato, Ph.D.		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	The animal using the hand, such as a monkey and human, often uses the hand while looking with eyes. This is because an object treated by hand is present outside a body, and the information such as the position, size, and form depends on what you must get visually. In addition, the ocular movement acts to catch the outside world on retina so that these visual informations are provided appropriately. In this way, as for the sight to process space information and the exercise of hand, arm, and ocular movements, information processing is performed to work mutually all in one body as one system. The present lecture, in the first half, will give an outline mainly in a textbook-like general statement for the visual and motor system of the brain, and in the latter half, detailed explanatioin using representative treatises about the components of the system representing the visuomotor function.		
Topics/Schedule（授業計画）	1. General statement about the anatomy and the physiologic function of the brain 1.1 Processing system for visual information 1.1.1 Subcortical 1.1.2 Cerebral cortex 1.2 Control system for hand and arm movement 1.2.1 Primary motor, premotor, and supplementary-motor cortices 1.2.2 cerebellum and basal ganglia 1.3 Control system for ocular movement 2. Detailed explanation about anatomy and physiological functions of the components of the visuomotor system, using the representative treatises 2.1 Frontal eye field 2.1.1 Saccadic eye movement 2.1.2 Smooth-pursuit eye movement 2.1.3 Eye movements evoked by electrical stimulation 2.2 Supplementary eye field 2.2.1 Learning for eye movement 2.2.2 Object-centered frame of reference 2.3 Parietal eye field 2.3.1 Activity affected by eye position 2.3.2 Head-centered frame of reference 2.4 Superior colliculus 2.4.1 Saccadic eye movement 2.4.2 Eye fixation 2.5 MT and MST 3. Examination		
Evaluation/Grading Policy（成績評価方法）	Total of an attendance manner (40%) and the evaluation by the examination (60%). The examination is performed for around 30 minutes at the last lecture time. At the examination time, you may refer to any documents such as the reference book distributed in the lecture.		
Remarks（履修上の注意）	It is desirable to have a basic neurophysiological knowledge such as action potential and a synaptic potential.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Before atttending at the lecture, you should look over the text document distributed before the lecture. The reference book (see 1a below) is helpful for you to understand the lecture after having taken a look on the book as preparations for the lecture because the book has a lot of figures relatively easy understand.		
Textbooks, References（教科書・参考書・資料）	The textbook in particular is not used. The reference books are as follows; (1) Principles of neural science, 5th ed. By Kandel ER et al., McGraw-Hill Professional (2012/10/26) (1a) Essentials of Neural Science and Behavior by Eric R. Kandel et al., Appleton & Lange (1996/9/30) (2) From Neuron to Brain by John G. Nicholls and A. Robert Martin, Sinauer Associates Inc; 5th ed. (2011/11/15) (3) Fundamental Neuroscience, Fourth Edition, By Larry Squire and Darwin Berg., Academic Press (2012/11/20) (4) Neuroanatomy by P.F.A. Martinez Martinez, Philadelphia, PA : Saunders, 1982		
Language（使用言語）	Usually perform the lecture in Japanese, or explain the correspondence individually when there is a student attending a lecture needing explanation in English.		

Course Title（科目名）	Laboratory Animal Science		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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, regenerative medicine using iPS cells, etc.By doing so, we aim to acquire a higher level of laboratory animal science, which is indispensable for most-advanced medical research.		
Topics/Schedule（授業計画）	1. Overview of Laboratory Animal Science! (Medical research, extrapolation, genome, *in vivo, in vitro*) 2. Regulations and guidelines of the relevant animal experiments (Act on Welfare and Management of Animals, etc.) 3. Ethics of animal experimentation (3Rs, pain degree classification (SCAW), humane endpoint, etc.) 4. Animal welfare (relief of pain, environmental enrichment, wellbeing, alternative methods, veterinary care) 5. Care and management of the experimental animals (feed, drinking water, cages, bedding, ILAR Guide) 6. Laboratory animals and the environment (environment control, engineering control, temperature and humidity control, lighting and air flow control, noise and vibration control) 7. Types and their characteristics of the experimental animals (mice, rats, hamsters, guinea pigs, rabbits, etc.) 8. Comparative biology (anatomy, physiology, metabolism and nutrition, clinical application, species differences, strain differences) 9. Disease model animals (spontaneous animal, genetically modified animals, etc.) 10. Infectious diseases and its prevention of the experimental animals (disinfection and sterilization, microbial monitoring, epidemiology, virus, bacteria, fungi, parasites) 11. Prevention of zoonoses (hemorrhagic fever with renal syndrome, lymphocytic choriomeningitis, etc) 12. Laboratory animal allergy (allergen, immediate hypersensitivity, sensitization, asthma, anaphylaxis, PPE, IVC, one-way air flow control) 13. Laboratory animals and developmental engineering (embryo freezing, sperm freezing, artificial insemination, genome editing, CRISPR / Cas9) 14. Experimental animal technology (appropriate anesthesia, appropriate euthanasia, accurate handling, administration, sampling) 15. Advanced medical research and experimental animal (ES cells, iPS cells, cloned animals, regenerative medicine, bioresources)		
Evaluation/Grading Policy（成績評価方法）	Grades are assessed by attendance, expected preparation and review, and assignment reports. Problems in the assignment report are announced during class.		
Remarks（履修上の注意）	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.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	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		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Behavioral cognitive psychology		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1. Definition and Classification of Motor Skills 2. Information Process of Movement 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		
Evaluation/Grading Policy（成績評価方法）	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.		
Remarks（履修上の注意）	None		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Introduce as appropriate during the lecture.		
Language（使用言語）	tures are given in Japanese. However the teacher will explain individually to those students who need explanation		

Course Title（科目名）	Basic Neuroscience 2		
Lecturer（担当教員）	Kiyohisa NATSUME		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	The aim of this course is to understand evolusional processes of the central nervous sytems in different species and their basic brain structure and functions. Basic property of neuron and grial cells, hierarchical structue and function of the brain are discussed.		
Topics/Schedule（授業計画）	1 Structure of biological systems: cell, tissure, organ 2 Evolusion and development of biological systems and nervous sytem 3 Cellular basis of neurons and grial cells 4 Cental nervous system 5 Peripheral nervous system 6 Neural cirquits and neurotransmitters 7 Spinal cord: Reflex 8 Brain stem and cranial nerves: Autonomic functions 9 Celebellum: Motr control and skill learning 10 Thalamus: Cortico-subcortical relay of sensory and motor signals 11 Hypothalamus: Instinctive behaviors and related visceral functions 12 Basal ganglia: Involuntary movements and reward 13 Limbic system: Emotion, learning and memory 14 Cerebral cortes: sensory perception and voluntary movements 15 Hier brain functions: Decision making and soucial functions		
Evaluation/Grading Policy（成績評価方法）	Regular examination (70%), Short report after each lecture.		
Remarks（履修上の注意）	Basic knowleges of brain science, physiology and biology may help better understanding but not essencial.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Dowload lecture materials and read them before each lecture. Recheck contents of lecture materials and them for short reports after each lecture.		
Textbooks, References（教科書・参考書・資料）	Lecture materials are uploaded in "LiveCampus"		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Practicum in Neural Information Processing		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	[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)		
Evaluation/Grading Policy（成績評価方法）	There are no exams, but students are required to write reports. Part 1 (50 %) and Part 2 (50 %).		
Remarks（履修上の注意）	To have this class, you should take classes, Basic Neuroscience.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	[Part1] Explanatory material of the neural activity recorded data is distributed. You don't use a textbook. Reference books: Ion channels of excitable membranes, 3nd edition, Berttil Hille, Sinauer Associates, Inc. (2001) [Part2] An textbook will be distributed in the class. Reference books: 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		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Team Management		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	Department of Human Intelligence Systems Team Management, TM_2017 (2.0 units; Elective Course/Senmon Kamoku) Instructor: Doosub Jahng, Ph.D. Lecture: Thurs 8:50–12:00 (90 min x 16 = 24 hrs.), 2nd Q Location: Room 7510 Course Description: This course will focus on the use of the interface concept when approaching the challenges of team management. Students will be exposed to basic research methods and gain insight into the scientific processes involved in carrying out a research project. Students will develop critical thinking skills needed to analyze the research questions and will learn how to work as a team. Course Objectives: 1. Discuss the historical significance and growing importance of soft skills. 2. Understand the organizational communication hierarchy and related models/ theories. 3. Diagnose situations and formulate appropriate solutions based on results from surveys. 4. Develop skills needed for team communication including visualization of evaluation, mission setting and sharing, information sharing, and scheduling.		
Topics/Schedule（授業計画）	1. Learning Tools Guidance; KWM (Key Words Meeting ®), Table Whiteboard, Multiscreen, and KW Map 2. Self-introduction, Study groups setting, Group Introduction 3. System and Management, PDCA Cycle 4. Hierarchy of Organizational Communication, SWOT Analysis 5. Team Communication Interface, 3 Proposals 6. TOW Cycle, 8w3h1s 7. WESKT Presentation Preparation Methods 8. Information Relay Model 9. 70% Scheduling 10. Evaluation and Estimation 11. Administrator, Leader, and Manager 12. Communication: Theory and Model 13. Marketing: Concepts and Survey of Needs 14. Diversity and Multi-facets 15. Course Reflection 16. Career Path		
Evaluation/Grading Policy（成績評価方法）	Grading Outline: Learning activity, After-class submission, Review of feedback, and In-class participation. Student Assessment: Grading Outline breakdown will be discussed and adjusted throughout the course. Students will be given the opportunities to negotiate with the professor and will be encouraged to use their negotiating skills and learn how to mold consensus when discussing the percentage breakdown. Class grading will involve interactive communication for a two-way learning experience.		
Remarks（履修上の注意）	Remarks on Attendance: Students who fail to attend the first day of class without prior notice will be dropped from the course. For maximum efficiency, course enrollment will be limited to 25 seats. Special exceptions will be given to highly motivated students who wish to take the course.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Extensive before-class preparation, in-class participation and reflection of feedbacks will be crucial to ensuring the class' success. Students will be expected to consistently submit their reports and review professors' feedbacks on KWM before attending the next lecture. Students who don't wish to use KWM will be required to submit written learning reports. (Come talk to me separately for further information.)		
Textbooks, References（教科書・参考書・資料）	Doosub Jahng, Three Fundamentals of Efficient Worklife in Team, JISHA, 2003 (Japanese)		

Language （使用言語）	English, Japanese, or a combination of the two will be used throughout the course. The students' overall language abilities will be taken into account during lectures and discussions. One exception to this policy is KWM feedback, which will be solely given in Japanese. When using Table Whiteboard during team discussion, students will be asked to write Furigana when using Kanji. International students are highly encouraged to bring Japanese/English dictionary and are welcome to write in English on whiteboards. It is hoped that these measures will facilitate mutual learning process between international students and their fellow, native colleagues.

Course Title(科目名)	Molecular sensing systems		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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		
Evaluation/Grading Policy (成績評価方法)	Your final grade will be calculated according to the following process: attitude in class, short test for each topic, and end-of-term examination.		
Remarks (履修上の注意)	Admission to this course will be recommended after taking Basic Neuroscience		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Materials for the lecture will be distributed to students at each lecture.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Mathematical Neurophysiology B		
Lecturer(担当教員)	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 Objectives/Outlines (目的・概要)	This course, which was 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.		
Topics/Schedule (授業計画)	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		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class will be determined based on the following: - Quizzes: 30% - Final exam: 70%		
Remarks (履修上の注意)	Students are expected to earn a credit for "Basic Neuroscience".		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Reference books: 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		
Language (使用言語)	This course will be taught in Japanese. However, all course materials are in English.		

Course Title（科目名）	Mathematical Neurophysiology A		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	This course, which was 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.		
Topics/Schedule（授業計画）	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		
Evaluation/Grading Policy（成績評価方法）	Your overall grade in the class will be determined based on the following: – Quizzes: 30% – Final exam: 70%		
Remarks（履修上の注意）	Students are expected to earn a credit for "Basic Neuroscience".		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Reference books: 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		
Language（使用言語）	This course will be taught in Japanese. However, all course materials are in English.		

Course Title（科目名）	Information Processing using Brain Dynamical System		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	In the class, I pick up the topic on the local neuronal network related to memory, motor control, and neuronal oscillation, and also pick up the topic on the Brain Machine Interface. In the first two classes, I review the basic knowledge of the neuroscience.		
Topics/Schedule（授業計画）	1. The basics of neuroscience ～Molecular biology～ 2. The basics of neuroscience ～Neurophysiology～ 3. Basic neuronal networkI ～From formal neuron to computer 4. Basic neuronal networkII ～From formal neuron to computer 5. Neuronal rhythm networkI ～Central Pattern Generator (CPG) in Lamprey～ 6. Reflexion neuronal networkI ～The quick response of the brain to the stimulus～ 7. Reflexion neuronal networkII ～The control of the reflexion circuit by the brain～ 8. The rhythmic neuronal network in the cortex ～The neuronal network relating to the movement～ 9. Neuromodulation networkI ～Sleep and wake cycle～ 10. Neuromodulation networkII ～The relation of the force learning～ 11. The neuronal network relating to the memory ～Reveberating circuit, Hebb, and STDP rule～ 12. The neuronal network relating to the memory ～The corttical, and hippocampal circuit～ 13. Cell assembly neuronal network ～The unit in the information processign in the brain ～ 14. The neuronal map in the brain ～The representation of the brain function ～ 15. Brain machine interface ～The controls of the machine using brain signals～		
Evaluation/Grading Policy（成績評価方法）	There are no exams, but students are required to write reports. Your final score will be calculated based on the following points; Assessment of performance score 32%, and Reports score 68%.		
Remarks（履修上の注意）	To have this class, you should take two basic classes, Basic Neurosciences. You should submit the reports via Moodle.		
Expected preparation and review（授業外学習（予習・復習）の指示）	To prepare for the next class, please look up the meaning for unknown words. Students are expected to review what you learned in the class, and utilize that for the report.		
Textbooks, References（教科書・参考書・資料）	M.F. Bear et al., "Neuroscience: Exploring the Brain, 4th Edition", Lippincott Williams and Wilkins; 4th edition (2015) D. Purves et al. "Neuroscience, Fifth Edition", Sinauer Associates, Inc. (2011)		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English on a different day if there are students who need explanation in English.		

Course Title(科目名)	Fundamentals of Mathematics		
Lecturer(担当教員)	Tetsuo Furukawa, Hiroaki Wagatsuma		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	This course deals with the basic concepts and principles of linear algebra as a fundation of engineering and mathematical analysis for understanding of tools to explore a function behind the data obtained in a limited and discrete way. 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. (A) deals with the foundations, (B) deals with more developmental and applied contents.		
Topics/Schedule (授業計画)	Linear algebra (A) 1 Elemental operations of matrices and vectors 2 Linear mapping and matries 3 Numerical vector space and dimension 4 Linear system and solution space 5 Determinant 6 Eignevalue and eigenvector 7 Applications of eigenvalue 8 Midterm examination Linear algebra (B) 9 Abstract vector space 10 Inner product and norm 11 Orthogonal matrix and orthonormal system 12 Differentiation of vectors and matries 13 Quadratic form and optimization problems 14 Rectangular matrices and generalized inverse 15 Matrix decompositions 16 Final examination Mathematical analysis (A) 1 Limit and continuity of real numbers 2 Infimum, supremum and continuous functions 3 Definition of derivative and differentiation 4 The convex function and subdifferential 5 Infinite series and Taylor expansion 6 Integrals and Riemann sum 7 Ordinary differentials and its differential equation 8 Midterm examination Mathematical analysis (B) 9 Partial differentiations (grad, div and curl) 10 The method of Lagrange multiplier 11 Multiple integral (curvilinear and surface integrals) 12 Methods of numerical integration 13 Partial differential equations and difference approximation 14 Finite element method (FEM) and boundary element method (BEM) 15 Euler–Lagrange equation and simple harmonic motion 16 Final examination		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class is decided based on the followings: Linear algebra 50% (A: 30%, B 20%), Mathematical analysis 50% (A: 30%, B: 20%). You must pass the examinations of BOTH linear algebra (A) and mathematical analysis (A) at least.		
Remarks (履修上の注意)	This course is designed for graduate students who have already acquired the elementary skills of linear algebra and mathematical analysis. It is desirable that students brushup on the elementary knowldege before taking this class.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Preparation: Download the materials in advance, and prepare the class. Review: Some questions are indicated in the class. Solve them and submit the answers as weekly reports.		
Textbooks, References (教科書・参考書・資料)	Materials is provided in the class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Brain Inspired Artificial Intelligence		
Lecturer(担当教員)	Motoaki Kawanabe, Eiji Uchibe, Stefan Elfwing		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	1. Introduction to decision making theory 2. Bandit problem 3. Reinforcement learning (1): value-based reinforcement learning 4. Reinforcement learning (2): policy search method 5. Reinforcement learning (3): inverse reinforcement learning 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 (1) 14. Machine learning for neural decoding (2) 15. Neurofeedback		
Evaluation/Grading Policy (成績評価方法)	Students are assessed according to their performance on the course report.		
Remarks (履修上の注意)	Report submission is required because course content is given in lectures.		
Expected preparation and review (授業外学習(予習・復習)の指示)	Reading handouts in advance and preparing a report after the lectures.		
Textbooks, References (教科書・参考書・資料)	No textbook		
Language (使用言語)	Lecture is conducted in Japanese. If a student desires a lecture in English, this may be arranged on an individual basis.		

Course Title(科目名)	Brain-Inspired Information Processing B
Lecturer(担当教員)	Hiroaki Wagatsuma
Course intended for (対象学年)	1st year student
Credit Category(単位区分)	Credits(単位数)
Course Objectives/Outlines (目的・概要)	We explore systems design inspired by biological emergent intelligence, such as human intelligence. For the analysis of how we are embodied in the environment (body kinetics/morphology), why emotional and social aspects are so important to us (sociality), the deep understanding of dynamics is necessary. In this lecture, mathematical theory to treat signal processing and system control is provided with MATLAB programming codes.
Topics/Schedule (授業計画)	1. Basics of signal processing and control theory 2. Linearity and time invariant system 3. Impulse response and transfer function 4. Linear model and classical control theory 5. Vector filed as derivations 6. Continuous map and maniforld 7. Nonlinear system and topological space 8. Model-based design and adaptive control
Evaluation/Grading Policy (成績評価方法)	Assignment score every class (40%) and final report or exam (60%). The evaluation will be done totally.
Remarks (履修上の注意)	For true understanding, expected preparation on basics of mathematical analysis is highly recommended, which corresponds to the content of Fundamentals of Mathematics II.
Expected preparation and review (授業外学習 (予習・復習)の指示)	(Expected preparation)read the text book and try to run related MATLAB codes. (Review)submit assingments that requested in the last lecutre.
Textbooks, References (教科書・参考書・資料)	Textbooks: i) V.K. Ingle & J. G. Proakis (2007,2012) "DIGITAL SIGNAL PROCESSING using MATLAB (Third Edition)," Cengage ii) K. Ogata (2007) "MATLAB for Control Engineers" Prentice Hall iii)L. W. Tu (2010) "An Introduction to Manifolds (Universitext) 2" Springer
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.

Course Title（科目名）	Brain Inspired Information Processing A		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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 image processing technologies, (2) to describe how visual systems work subjectively, (3) to explore advanced image processing technologies.		
Topics/Schedule（授業計画）	1 Fundamentals of Visual Information Processing (1) 2 Fundamentals of Visual Information Processing (2) 3 Color Systems 4 Color Image Processing 5 Advanced Visual Information Processing 6 Subjective Visual Information Processing 7 Kansei Information Processing 8 Advanced Kansei Information Processing		
Evaluation/Grading Policy（成績評価方法）	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.		
Remarks（履修上の注意）	This course is not recommended for students who have mastered basic image processing technologies. Students should take the course of Fundamentals of Mathematics.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Download handouts in advance and read them before attending.		
Textbooks, References（教科書・参考書・資料）	No textbooks required. References will be introduced in the lecture if necessary. Lecture handouts are distributed through LiveCampus.		
Language（使用言語）	Usually lectures are given in English. However we will have lecture in Japanese if there are students who need explanation in Japanese		

Course Title（科目名）	Brain-Inspired Learning Theory B		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	Lecture on reinforcement learning theory field which is a big field of brain type learning theory. First, fundamental multiband Bandit problem, dynamic programming method. Next, after studying TD learning and strategy gradient method which are the core of learning theory, learn advanced cutting-edge reinforcement learning method and reverse reinforcement learning method.		
Topics/Schedule（授業計画）	1 Introduction 2 Multiarm Bandit Problem 3 Dynamic Programming 4 TD Learning 5 Policy Gradient Learning 6 Deep Reinforcement Learning 7 Inverse Reinforcement Learning 8 Summary		
Evaluation/Grading Policy（成績評価方法）	Evaluation is conducted together with reports, tasks imposed during class and final exams.		
Remarks（履修上の注意）	Class Mathematics Foundation is essential.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	There is no particular textbook. The reference book is as follows. (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		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Brain-Inspired Learning Theory A		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1 Introduction 2 Computational Theories of the Brain 3 Perceptrons 4 Self-Organization Maps 5 Hopfield Networks 6 Boltzmann Machines 7 Deep Neural Networks 8 Summary		
Evaluation/Grading Policy（成績評価方法）	Evaluation is conducted together with reports, tasks imposed during class and final exams.		
Remarks（履修上の注意）	Class Mathematics Foundation is essential.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	There is no particular textbook. The reference book is as follows. (1) Haykin:Neural Networks, Prentice Hall, 1999 (2) Goodfellow, et al.:Deep Learning, The MIT Press, 2016.		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Fandamental Machine Learning 2B		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	Regarding machine learning, regression, classification, which is a framework of supervised learning, dimensionality reduction and clustering which are unsupervised learning, interworking topics on the latest artificial intelligence, as a developmental topic , semi supervised learning, metastatic learning, multitasking learning and so on are introduced.		
Topics/Schedule（授業計画）	1. Abnormality Detection 2. Unsupervised Dimensionality Reduction 3. Clustering 4. Semi-superbised Learning 5. Supervised Dimensionality Reduction 6. Transfer Learning 7. Multi-task Learning 8. Summary		
Evaluation/Grading Policy（成績評価方法）	Evaluation is achieved based on the reports and KWM (key Words Meeting).		
Remarks（履修上の注意）	Attendance to Fandamental Mathematics is nessesary.		
Expected preparation and review（授業外学習（予習・復習）の指示）	After each class, students are required to review the class using the KWM system.		
Textbooks, References（教科書・参考書・資料）	Materials are introduced in the classes.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Fandamental Machine Learning 2A		
Lecturer（担当教員）	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 Objectives/Outlines（目的・概要）	Regarding machine learning, regression, classification, which is a framework of supervised learning, dimensionality reduction and clustering which are unsupervised learning, interworking topics on the latest artificial intelligence, as a developmental topic , semi supervised learning, metastatic learning, multitasking learning and so on are introduced.		
Topics/Schedule（授業計画）	1. Machine Learning, and Learning Models 2. Least Squares Learning 3. Constrained Least Squares Learning 4. Sparse Learning 5. Classification based on Least Squares Learning 6. Support Vector Machines 7. Ensemble Learning 8. Summary		
Evaluation/Grading Policy（成績評価方法）	Evaluation is achieved based on the reports and KWM (key Words Meeting).		
Remarks（履修上の注意）	Attendance to Fandamental Mathematics is nessesary.		
Expected preparation and review（授業外学習（予習・復習）の指示）	After each class, students are required to review the class using the KWM system.		
Textbooks, References（教科書・参考書・資料）	Materials are introduced in the classes.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Machine Learning 1B		
Lecturer（担当教員）	Tetsuo Furukawa		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	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		
Evaluation/Grading Policy（成績評価方法）	Your overall grade in the class is decided based on the followings: weekly report (50%) and term-end examination (50%).		
Remarks（履修上の注意）	It is necessary to take "Fundamental of Mathematics" and "Machine Learning 1A".		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Reference: C.M. Bishop, "Pattern recognition and Machine Learning"		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Machine Learning 1A		
Lecturer（担当教員）	Tetsuo Furukawa		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・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		
Topics/Schedule（授業計画）	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		
Evaluation/Grading Policy（成績評価方法）	Your overall grade in the class is decided based on the followings: weekly report (50%) and term-end examination (50%).		
Remarks（履修上の注意）	It is necessary to take "Fundamental of Mathematics". Students who will take "Machine Learning 1B" need to take this course.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	No text book is needed. Some references are introduced in the class.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Basic Engineering (Introduction to Electric Circuits and Mechanics)		
Lecturer（担当教員）	Prof. Hirofumi Tanaka		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	Knowledge of electric circuits is essential to learn variety of electric systems as well as function of living organism. This course introduce basic concepts from linear DC circuit to transient response. To promote understanding exercise is performed. For analysis of AC circuit, it is introduced that concept of impedance and admittance induced complex number allows expanding DC circuit spontaneously. The aim of this course is to read and to understand directly from English textbook. Furthermore advanced electric devices and integrated circuit technologies are introdecued and added to the exersice questions. Knowledge of dynamics is indispensable not only for robots and mechanical systems but also for learning functions of living bodies. Here, lecture on the basic knowledge of the dynamics of the mass point system from the basic law of dynamics and exercise. Basically, I do classes of exercises to solve exercises of textbooks, but introduce topics of advanced robot technology in each item.		
Topics/Schedule（授業計画）	1. Introduction (Chap. 1, 2), Ohm's Law, Kirchhoff's Law, Thevenin's and Norton's Theorems (Chap. 3-5) 2. Superposition Theorem, Max. Power Transfer Theorem, Y-Δ&Δ-Y Transform., Bridge Circuits (Chap. 5) 3. Exercise (Chap. 1-5) 4. Capacitors and Capacitor Current (Chap. 8), Inductors and Inductor Current (Chap. 9) 5. AC Voltage and Current, Phase relations, RMS, AC response, Polar Form, Phasor (Chap. 10, 11) 6. Impedance, Admittance (Chap. 12) 7. Exercise (Chap. 8-12) 8. Exercise (All) 9. Speed, Displacement, and Velocity: An Introduction to Vectors(Chap.1), Exercise 10. Uniformly Accelerated Motion(Chap.2), Exercise 11. Newton's Laws (Chap.3) , Exercise 12. Equilibrium Under the Action of Concurrent Forces (Chap.4), Exercise 13. Equilibrium of a Rigid Body Under Coplanar Forces (Chap.5), Execise 14. Work, Energy, and Power (Chap.6), Exercise 15. Exercise 16. Test		
Evaluation/Grading Policy（成績評価方法）	Grading will be comprehensively evaluated by attitutde to exercise in class, short reports and term-end examination.		
Remarks（履修上の注意）	N/A		
Expected preparation and review	Participants requested to read corresponding parts of textbook before classes.		
Textbooks, References（教科書・参考書・資料）	Textbook : 1st half : Basic circuit analysis, Jhon O'malley, Schaum's outlines, McGraw-Hill 2nd half : College Physics, Eugene Hecht, Schaum's outlines, McGraw-Hill		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Introduction to Computer Systems		
Lecturer（担当教員）	Takashi Morie, Hakaru Tamukoh		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	The objective of this course is to understand the fundamental concepts of computer systems that enable programs to execute on real hardware. The former part of this course provides the basics of the von Neumann architecture and digital hardware based on logic circuits. The latter part addresses the fundamental principles of MOS devices, with which current digital computers are constructed.		
Topics/Schedule（授業計画）	1. The von Neumann architecture 2. Microprocessors and programming 3. CPU, GPU, FPGA 4. Logic circuits 5. Fundamentals of semiconductors and p-n junctions 6. Fundamentals of MOS devices 7. Basic operation of MOS transistors 8. Fundamentals of CMOS integrated circuits		
Evaluation/Grading Policy（成績評価方法）	Based on the results of mini-tests after classes and/or reports assigned several times.		
Remarks（履修上の注意）	Students are expected to have learned basics of electric circuits, logic circuits and computer systems.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Lecture materials are uploaded at "Live Campus". References are announced in classes.		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Practicum in Intelligent Machine Design		
Lecturer（担当教員）	Chikamune WADA and Hakaru TAMUKOH		
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 Objectives/Outlines（目的・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 digital circuit design using Field Programmable Gate Array (FPGA) for signal processing.		
Topics/Schedule（授業計画）	1. LabVIEW (I/O) 2. LabVIEW (Signal processing) 1 3. LabVIEW (Signal processing) 2 4. LabVIEW (Real tme processing) 5. Basic knowledge of electromyogram 6. Designing analog circuit 1 7. Designing analog circuit 2 8. LabVIEW (EMG signal processing) 9. Introduction to FPGA and digital circuit design 10. Tutorial on Xilinx ISE 11. Digital circuit design using FPGA 1 12. Digital circuit design using FPGA 2 13. Advanced FPGA design 1 14. Advanced FPGA design 2 15. Advanced FPGA design 3 16. Advanced FPGA design 4		
Evaluation/Grading Policy（成績評価方法）	Evaluation will be done by attendance and achievement to the practice.		
Remarks（履修上の注意）	Students (who entered after 2018/Apr) should take #1-#4 and #9-#12 classes, for getteing 1 credit. Students (who entered before 2018/Mar) should all 16 classes, for getting 2 credits.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students will be expected to do practice for LabVIEW/Xilinx ISE.		
Textbooks, References（教科書・参考書・資料）	Necessary material will be provided.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Intelligent Digital Integrated Circuits		
Lecturer(担当教員)	Hakaru Tamukoh		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	With the continuous progress of integrated circuit technology, in recent years, it has become possible to implement around 10 billion transistors in one chip. Digital hardware based on logic circuits realized by this integrated circuit technology is an extremely important device for supporting our advanced information society. This course will provide the latest topics related to integrated circuits and explain fundamental knowledge about embedded image processing by logic circuits. The aim of this course is to understand digital hardware architecture and its performance evaluation.		
Topics/Schedule (授業計画)	1 Embedded Real-time Image Processing 2 Field Programmable Gate Array (FPGA) 3 Design Process 1: Problem specification 4 Design Process 2: Algorithm Development, Architecture Selection and System Implementation 5 Mapping Techniques 1: Timing Constraints 1 6 Mapping Techniques 2: Timing Constraints 2 7 Mapping Techniques 3: Memory Bandwidth Constraints 8 Mapping Techniques 4: Resource Constraints		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class is decided based on the followings: weekly report (50%) and term-end examination(50%).		
Remarks (履修上の注意)	Students are expected to have learned basics of logic circuits, programming and computer systems.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Study the meaning of unknown technical term as preparation for the next lecture. After the class, list the keywords and investigate the research related to that keywords in books or search engine for academic texts.		
Textbooks, References (教科書・参考書・資料)	Donald G. Bailey, "Design for Embedded Image Processing on FPGAs", IEEE, John Wiley & Sons (Asia) Pte Ltd, 2011.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Intelligent integrated systems 2		
Lecturer(担当教員)	Prof. Hirofumi Tanaka		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Objectives/Outlines (目的・概要)	In recent years, the electrical devices are certainly and rapidly down sizing. Size of a devices has achieved to several tens of nanometers. Physical properties of the devices in nanostructure have been different from that of macroscopic size because of perturbation. Mesoscopic physics is organized study of physical phenomena appeared in nanoscale. Without understanding the mesoscopic phenomena, integrated circuit of nanodevices can not be realized. In this course, to systematically study that the electronics in nanoscale elucidated in recent years by mesoscopic physics, and also to understand the phenomena which may occur in integration of nanodevices, basics of the nanostructure electronics is introduced in the first half, and basics of the electrical properties of nanomaterials except silicon semiconductor is introduced in the second half.		
Topics/Schedule (授業計画)	1. Introduction, Basic Concept of Mesoscopic Conduction 2. Conduction Mechanism in Solid 3. Electric Physics in Nanostructures 4. MOS Nanotransistor 5. Organic Conductor 6. Nanocrystals, Clusters and Nanoparticles 7. Nanocarbon systems (C60, Carbon Nanotubes and Graphene) 8. New Principles and New Concept of Transistors, Conclusion 9. 10. 11. 12. 13. 14. 15.		
Evaluation/Grading Policy (成績評価方法)	Grading will be comprehensively evaluated by attitude to journal discussion in class and short reports.		
Remarks (履修上の注意)	N/A		
Expected preparation and review (授業外学習(予習・復習)の指示)	Participants are requested to read resume supplied before classes and to read journal articles on related topics in previous week class for discussion in class.		
Textbooks, References (教科書・参考書・資料)	Resume and journal articles will be supplied via Live Campus.		
Language (使用言語)	Usually lectures are given in English.		

Course Title(科目名)	Intelligent integrated systems 1		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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. Merged analog/digital brain-like integrated circuits		
Evaluation/Grading Policy (成績評価方法)	Based on the results of mini-tests after classes, reports assigned several times, and the test at the last class.		
Remarks (履修上の注意)	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".		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Lecture materials are uploaded at "LiveCampus". References are announced at the first class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Human Function Substitution System		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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		
Topics/Schedule（授業計画）	1. Introduction and neural system 2. Visual system 3. Substitution for visuall system 4. Auditory system and vocalization 5. Substitution for auditory system and vocalization 6. Motor system: Bone, muscle, upper limb, lower limb, trunk 7. Substitution for motor system 8. Internal organs and its substituion system: Heart, lungs, kidneys, pancreas 9. 10. 11. 12. 13. 14. 15.		
Evaluation/Grading Policy（成績評価方法）	Grading will be based on attendance and reports.		
Remarks（履修上の注意）			
Expected preparation and review（授業外学習（予習・復習）の指示）	The students should download course materials in advance and read them.		
Textbooks, References（教科書・参考書・資料）	This course will not use a texbook. Course materials can be downloaed in advance.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Biomimetics		
Lecturer（担当教員）	Takayuki MATSUO		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	Biomimetics is the imitation of the models, systems, and elements of nature for the purpose of solving complex human problems. Living organisms have evolved well-adapted structures and materials over geological time through natural selection. Biomimetics has given rise to new technologies inspired by biological solutions at macro and nanoscales. Nature has solved engineering problems such as self-healing abilities, environmental exposure tolerance and resistance, hydrophobicity, self-assembly, and harnessing solar energy.		
Topics/Schedule（授業計画）	1 Introduction to Biomimetics 2 Technology inspired by walking robot 3 Technology inspired by walking robot 4 Technology inspired by walking robot 5 Technology inspired by swimming robot 6 Technology inspired by swimming robot 7 Technology inspired by swimming robot 8 Technology inspired by snake-like robot 9 Technology inspired by snake-like robot 10 Technology inspired by snake-like robot 11 Technology inspired by flying robot 12 Technology inspired by flying robot 13 Bio-sinpired information technology 14 Bio-sinpired information technology 15 Bio-sinpired information technology		
Evaluation/Grading Policy（成績評価方法）	Evaluate by weekly reports.		
Remarks（履修上の注意）			
Expected preparation and review（授業外学習（予習・復習）の指示）	Mathmatics of University leves is required at least.		
Textbooks, References（教科書・参考書・資料）			
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Robot Learning and Control		
Lecturer（担当教員）	Hiroyuki Miyamoto		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	1
Course Objectives/Outlines（目的・概要）	This course introduce the characteristics, design, application of mechanical system such as robot using brain type computer focusing on the following items.		
Topics/Schedule（授業計画）	1 Reflection system, motor cortex, neuron model, 2 Computational approach, hierarchical model of voluntary motor control 3 Computational theory of trajectory generation, minimum jerk model 4 Minimum torque change model 5 Feedback error learning 6 Robot learning by watching 7 Current topics of brain type computer and robot 8 Final examination		
Evaluation/Grading Policy（成績評価方法）	Grading will be comprehensively evaluated by attitutde to exercise in class, short reports and term-end examination.		
Remarks（履修上の注意）			
Expected preparation and review（授業外学習（予習・復習）の指示）	Read the reference books or related reference books listed in the reference during the course period.		
Textbooks, References（教科書・参考書・資料）	Inform appropriately in class.		
Language（使用言語）	Usually lectures are given in Japanese. Handouts are writen in Japanese and English. Report and examination will in English if there are sutudent who need explanation in English.		

Course Title（科目名）	ロボット運動学（Robot Kinematics）		
Lecturer（担当教員）	石井　和男		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）			
Topics/Schedule（授業計画）	1. Introduction to Robotics 2. Trend on Robotics Research 3. Units 4. Mathematics for Robotics 5. Rigid Body Kinematics（Translational Motion, Rotational Motion） 6. Rigid Body Kinematics（Absolute Motion） 7. Rigid Body Kinematics（Relative Motion） 8. Rigid Body Kinematics（Link Mechanism, Instant Center of Velocity） 9. Coordinate Transformation 10. Homogeneous Transformation 11. Forward Kinematics, Inverse Kinematics 12. Jacobian Matrix and Output Force 13. Rigid Body Dynamics 14. Equations of Motion 15. Robot Control		
Evaluation/Grading Policy（成績評価方法）	In each class, ask an short exam about the topics.		
Remarks（履修上の注意）			
Expected preparation and review（授業外学習（予習・復習）の指示）			
Textbooks, References（教科書・参考書・資料）	Meriam, Mechanical Dynamics		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need		

Course Title(科目名)	Biothermal Engineering		
Lecturer(担当教員)	Hiroshi ISHIGURO		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	The living system is a complicated heat and mass transfer system and the thermal effect is useful to medical technology. The objective of this course is to give a lecture on fundamentals and applications of heat and mass transfer related to the living system and medicine technology on the basis of thermal engineering and heat transfer. Mathematical description of the event is also provided.		
Topics/Schedule (授業計画)	Introduction of thermal engineering related to living system and medical technology: 1. What is ″Biothermal Engineering″? Living body under thermal condition: physiological, high and low tempareatures. 2. Basic transport phenomena 3. Momentum transfer: Viscosity, Conservation equation of momentum, Friction and pressure drags 4. Heat transfer (1): Conduction heat transfer, Heat conduction equation 5. Heat tarnsfer (2): Convection heat transfer, Conservation equation of thermal energy, Thermal conductivity 6. Heat transfer (3): Radiation heat transfer, Basic laws of radiation heat transfer 7. Mass transfer: Mass diffusion, Convection mass transfer, Conservation equation of chemical species, Mass transfer coefficient 8. Dimensionless numbers and anlogy of transport phenomena 9. Living body under physiological temperature (1): Heat transfer in living body 10. Living body under physiological temperature (2): Heat transfer between living body and outside environment 11. Living body under high temperature (1): Damage 12. Living body under high temperature (2): Utilization of high-temperature effect in medical technology 13. Living body under low temperature (1): Damage, Cryosurgery 14. Living body unde low temperature (2): Cryopreservation 15. Thermal effects of electromagnetic wave, ultrasound and laser light on living body		
Evaluation/Grading Policy (成績評価方法)	Final grade will be detrmined mainly from final paper and quizzes.		
Remarks (履修上の注意)	Request to students: Undestanding of bases, phenomena and medical application on biothermal engineering, Notice for students: To learn basic heat transfer and/or thermal engineering in advance will be helpful for the class though not nesessary condition.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Through the class, handouts will be used. To review the class is basically very effective. If the preparation is needed, instruction will be given in advance.		
Textbooks, References (教科書・参考書・資料)	Textbooks are not used. References will be introduced in the class. Handouts will be given in the class.		
Language (使用言語)	Japanese language is used usually in the class. If english language need to be used, instructions will be given.		

Course Title(科目名)	Biofluid Engneering		
Lecturer(担当教員)	Masaaki TAMAGAWA		
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 Objectives/Outlines (目的・概要)	In-vivo and in-vitro flow such as blood flow, lymph flow, respiratory gas flow, flight of birds, swimming of fish, are strongly related to the maintaining of life. Engineering application of various flow phenomena in-vivo and in-vitro is an important problem concerning about realization of optimum flow system. From this viewpoint, flow phenomena in-vivo and in-vitro will be comprehended and fundamental knowledge of fluid dynamics necessary for analysis of its mechanism and the basis of rheology in blood flow will be obtained.		
Topics/Schedule (授業計画)	1. What is biofluid engineering? 2. Various Flows 3. Fundamentals of fluid mechanics (Deformation rate and conservation lows) 4. Newtonian fluid flow 5. Non-newtonian fluid flow 6. Dimension analysis and similarity low 7. Flow measurement 8. Introduction of biofluid engineering 9. Various flows in human body 10. Fundamentals in blood circulation 11. Fundamentals in bioreology(1) 12. Fundamentals in bioreology(2) 13. Fundamentals in bioreology(3) 14. Microvascular flow 15. Microvascular flow		
Evaluation/Grading Policy (成績評価方法)	The final grade will be evaluated by the quality of report and questionaries in the class.		
Remarks (履修上の注意)	Before taking this course, taking courses such as Fundamental of Fluid Dynamics, Fluid Dynamics, or Dynamics are preferable.		
Expected preparation and review (授業外学習(予習・復習)の指示)	As the questionaries will be taken in the class, previous topics should be reviewed after each class		
Textbooks, References (教科書・参考書・資料)	There are no specified textbooks. Lecture notes will be provided. General textbooks of fluid dynamics may be used as reference books. In addition to these, materials and related papers used in lectures will be distributed appropriately.		
Language (使用言語)	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need e		

Course Title（科目名）	Bio-MEMS		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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 about 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.		
Topics/Schedule（授業計画）	1. Introduction: What is MEMS? 2. Basic microfabrication technique 3. 3D microfabrication technique 4. Scale effect and electrostatic microactuators 5. Microactuators 6. Physical microsensors (1) 7. Physical microsensors (2) 8. Neural interfaces 9. Chemical microsensors and microfluidic devices 10. Cell analysis devices 11. Microliquid handling devices 12. Electrostatic manipulation of biological samples 13. Biomolecule detection devices (1) 14. Biomolecule detection devices (2) 15. Final examination 16. Review		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by quality of brief reports during lectures (50%) and score of final examination (50%).		
Remarks（履修上の注意）	The course materials must be downloaded from LiveCampus prior to each lecture.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	No textbooks are assigned. Reference literatures are given in the course materials.		
Language（使用言語）	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.		

Course Title（科目名）	Applied power electronics		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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 learned, for example power conversion and motor drive control.		
Topics/Schedule（授業計画）	1 Introduction of power electronics 2 Power Semiconductor devices 3 DC-DC conversion 4 DC-AC conversion(single phase inverter) 5 DC-AC conversion(three phase PWM inverter) 6 Principle of the electrical motors 7 Coordinate transformation and mathematical model of AC motor 8 Control method of the motor driving (Vector control) 9 Control system design(laplace transformation and state space equation) 10 Control system design (feedback control) 11 Torque control and speed control using observer theory 12 Minimum order observer and applied the disturbance compensation 13 Observer based position sensorless control 14 Applied power electronics to the Electrical Vehicle 15 Conclusion of the lecture		
Evaluation/Grading Policy（成績評価方法）	Class attendance and attitude in class/ Some reports		
Remarks（履修上の注意）	It is desirable about the follwing in under graduate class: Electric machine, control system, energy tramsmission The the demo version of the simulation software for the power electronics and control design are used inthe class; "PSIM" and "Scilab". Download and try to use them by yourselves. Breaf instruction of these software are explained in the class.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Download and read the documents of the class from "Live campus". Simulate and check the circuits explained in the class.		
Textbooks, References（教科書・参考書・資料）	All the documents of the class can be downloaded from "Live campus".		
Language（使用言語）	Usually lectures are given in Japanese. However we will have lecture in English if there are students who need explanation in English.		

Course Title（科目名）	Nano materias and energy conversion		
Lecturer（担当教員）	Tingli Ma		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	Introduction of globe warming, solar energy and solar cells, including types, structures, work pricinples, advatages and disadvantages of Si, CIGS, CdTe, and new concept solar cells. The lecture also introduce the batteries, such as Li- ion and Na-ion batteries, Fuel Cells		
Topics/Schedule（授業計画）	1 Globe warming and introduction of solar cell research 2 Sicon solar cells 3 CIGS and CZTS solar cells 4 CdTe and multijunction solar cells 5 Dye-sensitized solar cells 6 Organic solar cells 7 Perovskite solar cells 8 Progress in new concept solar cells 9 Nano inorganic materials and their applications 10 Nano materials and carbon materials and their applications 11 Photocatalyst and hydreogen production 12 Nano catalyst and fuel cells 13 Li-ion and Na-ion batteries 14 Metal bateries 15 Supercapacitors 16 Summary and report		
Evaluation/Grading Policy（成績評価方法）	Lecture 50%; Report:50%		
Remarks（履修上の注意）	Serach and learn the backgroud before each lecture		
Expected preparation and review（授業外学習（予習・復習）の指示）	Review after lecture		
Textbooks, References（教科書・参考書・資料）	PPT		
Language（使用言語）	Japanese／English		

Course Title（科目名）	Advanced Electrochemical Technology		
Lecturer（担当教員）	Shyam S. PANDEY		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	The aim of this course is to introduce the power of electrochemistry from fundamental levels to advanced application level. Starting from basic concepts of electrochemstry focussing mainly towards the application potential in the diverse field of technology. The main emphasis will be given on moving from the simplicity to the complexity. Lecture will be conducted in both of easy English as well as Japanese languages to enable both of Japanese as well as foreign students to grasp easily and conveniently.		
Topics/Schedule（授業計画）	1 Fundamentals of Electrochemistry-I 2 Fundamentals of Electrochemistry-II 3 Electrochemical Techniques-I 4 Electrochemical Techniques-II 5 Electrochemical Techniques-III 6 Technological Applications of Electrochemistry-I 7 Technological Applications of Electrochemistry-II 8 Electrochemistry and Dye-Sensitized Solar Cells 9 Electrochromic Devices 10 Electrochemical Sensors 11 Electrochemical Biosensors 12 Electrochemiluminiscent Devices 13 Primary Cells and Secondary Batteries 14 Fuel cells-I 15 Fuel cells-II 16 Final Summary		
Evaluation/Grading Policy（成績評価方法）	Evaluation based on performance during lectures, results of small tests and final report summarization		
Remarks（履修上の注意）	Nothing specifically		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students are advised to have prior study of the lecture consudering the suitable keywords before attending the lectures. During the course of the lectue, problems for self study will also be provided folloed by evalution.		
Textbooks, References（教科書・参考書・資料）	Nothing specifically. If necessary information about additional study will be provided at the end of the lectures.		
Language（使用言語）	In general lecture will be conducted in Japanese but in case of need due to large number of foreign students it will be in English and Japanese both.		

Course Title(科目名)	Semiconductor Power Devices		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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		
Evaluation/Grading Policy (成績評価方法)	Group project activity and presentation		
Remarks (履修上の注意)	None		
Expected preparation and review (授業外学習(予習・復習)の指示)			
Textbooks, References (教科書・参考書・資料)	Handout A. Grove, "Physics and Technologies of Semiconductor Devices," John and Wiley & Sons.		
Language (使用言語)	Usually lectures are given in English.		

Course Title（科目名）	Organic electronics for energy conversion		
Lecturer（担当教員）	Shuzi Hayase		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	Plants and other organisms realize efficiency energy conversion. Our purpose is to lean the efficient energy conversion from them and to realized them artificially with other architecture and material.This course ideals with various energy conversions consisting of organic and inorganic materials. The lecture topics include printable solar cells with artificial photosynthesis (Dye-sensitized solar cells, organic thinfilm solar cells, perovskite solar cells , hybrid solar cells), fuel cells, organic FET devices, and organic semiconductive materials employed for these printable devices.		
Topics/Schedule（授業計画）	1. Intorduction 2. Solar cells with artificial photosynthesis mechanism 1 3. Solar cells with artificial photosynthesis mechanism 2 4. Solar cells with artificial photosynthesis mechanism 3 5. Solar cells with artificial photosynthesis mechanism 4 6. Organic thin film solar cells 1 7. Organic thin film solar cells 2 8. Organic-inorganic hybrid solar cells and perovskite solar cells 1 9. Organic-inorganic hybrid solar cells and perovskite solar cells 2 10. Fuel cells 1 11. Fuel cells 2 12. Organic semiconductive material 1 13. Organic semiconductive material 1 14. Application 1 15. Application 2		
Evaluation/Grading Policy（成績評価方法）	Attendance:50%、Reprot: 50%		
Remarks（履修上の注意）			
Expected preparation and review（授業外学習（予習・復習）の指示）	Preparation for the next class and review for the last class.		
Textbooks, References（教科書・参考書・資料）	Without text		
Language（使用言語）	Language: Japanese. PPTs are described in English. The lecture will be partially done in English.		

Course Title（科目名）	Interdisciplinary Practice 1, 2		
Lecturer（担当教員）	Professor in charge of International Awareness Internship		
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 Objectives/Outlines（目的・概要）	By solving problems related (1) English language and (2) interdisciplinary research topics, it is expected to master international skills and obtain the ability to respond to different research fields at the worldwide level as well as domestic level.		
Topics/Schedule（授業計画）	As this course is conducted on OJT (On-the-Job Training), the schedule differs from case to case. For example, you can practice the English learning program necessary for research work by individual or group, the research program in a different field from your own field of research at laboratories or centers outside your laboratory, and the collaborative research program at overseas laboratories. · Make plan and carry out PBL (Project-Based Learning) in English. · Practice advanced research work in different fields at laboratories outside your laboratory or centers in the university. · Stay at overseas universities such as the universities with MOU for about one month, and conduct collaborative international research work. · Plan and carry out the interdisciplinary project for solving problem.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be evaluated by the quality of report.		
Remarks（履修上の注意）	In order to take Interdisciplinary Practice 2, it is necessary to take Interdisciplinary Practice 1		
Expected preparation and review（授業外学習（予習・復習）の指示）	Before this course, research contents should be surveyed by papers, internet or other methods to obtain necessary knowledge and related technology. During period of this course, (1) in case of the domestic and overseas research work, study should be conducted in the laboratory of the visiting institution while receiving instruction from the co-supervisor in order to obtain knowledge of different fields, (2) in case of the interdisciplinary project for solving problem, preparation should be conducted while receiving instructions from the project supervisor.		
Textbooks, References（教科書・参考書・資料）	Textbooks are not be specified, but reference books may be suggested. Materials may be distributed.		
Language（使用言語）	tures are given in Japanese. However the teacher will explain individually to those students who need explanation		

Course Title(科目名)	Exercises on Measurement Control Systems		
Lecturer(担当教員)	Seiya Abe		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	1
Course Objectives/Outlines (目的・概要)	This cource aims to learn signal processing, measurement systems, and control techniques toward eco-friendly electronic devices and human-friendly control systems. At first, it gives exercises in control of a digital circuit and a power electronic converter with a field-programmable gate array (FPGA). Then, it provides exercises in characteristic evaluations and signal processing for a photovoltaic cell with LabVIEW. Finally, it gives exercises in analysis and design of a control system using a motorized stage and MATLAB.		
Topics/Schedule (授業計画)	1. Basic operation of LabVIEW 2. Signal processing of a sensor with LabVIEW 3. Characteristic evaluation of a photovoltaic cell with LabVIEW 4. Signal processing of the photovoltaic cell and the sensor with LabVIEW 5. Basics of VHDL programming for FPGA 6. Control of LEDs with FPGA 7. Control of a power electronic converter (1) 8. Control of a power electronic converter (2) 9. Basic operation of MATLAB/Simulink 10. Simulation and control of a power electronic converter with PLECS 11. Analysis of a measurement system with MATLAB 12. Control of the measurement system with MATLAB 13. Design of a motorized stage with MATLAB 14. Diving contol of the motorized stage with MATLAB 15. Control of the motorized stage combined with a sensor with MATLAB (1) 16. Control of the motorized stage combined with a sensor with MATLAB (2)		
Evaluation/Grading Policy (成績評価方法)	Results of exercises and papers		
Remarks (履修上の注意)	Use the notebook computer lent by the depertment. Read documents for the course if they are provided in advance. Do not be absent without permission.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Preperations of the flollowings are recommended: ・Sampling theory and low-pass filters for using LabVIEW. ・A hardware description language of VHDL for learning FPGA. ・Linear algebra for learning MATLAB.		
Textbooks, References (教科書・参考書・資料)	Commercially available textbooks are not used. Documents will be provided and referenceres will be introduced for each exercises.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title（科目名）	Exercises on Computational Biomechanics		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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.		
Topics/Schedule（授業計画）	1. Finite element analysis of solid structures: identification of the material properties of a soft elastic material in a mechanical loading test 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 4. Computational fluid dynamics: numerical analysis of flows on pipe and stenosis which are models of blood 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		
Evaluation/Grading Policy（成績評価方法）	Grading will be decided based on your results of tasks in the exercises.		
Remarks（履修上の注意）	Students are requiered to have the knowledge of the strength of materials, fluid dynamics, dynamics of machinery and thermodynamics. 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).		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	Text books are not used. References may be introduced. Materials may be provided in each class.		
Language（使用言語）	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Micro-Technology		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	1. Guidance -Concept 2. Example of parts and products 3. Fundamentals of micro fabrications 4. Deposition 5. Removing 6. Modification 7. Junction 8. Elementary technology and actual fabrication for micro-technology 9. Actual PVD for micro-technology 10. Measurement and analysis of micro fabrications 11. Equipments 12. Fundamental of magnetism and magnetic material 13. HDD (hard disk drive) 14. MRAM (Magnetoresistive random-access memory) 15. Review		
Evaluation/Grading Policy (成績評価方法)	Grading will be decided based on quizes and reports.		
Remarks (履修上の注意)	Students should review the fundamental physics and chemistry.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	[prereration] The handout should be read deeply before attendance. [review] The handout should be understood after lecture.		
Textbooks, References (教科書・参考書・資料)	Handouts will be used.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Mechatronics		
Lecturer(担当教員)	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 Objectives/Outlines (目的・概要)	Aims of this course are to introduce a basic knowledge of Mechatronics and to practice some examples in order to operate the knowledge in actual scene. In order to get higher machine performance, Mechatronics covers various aspects of the engineering – machine, electricity/electronics, computer and control –, but to grasp easily and conveniently, this lecture will be conducted according to processes of "Stabilization of inverted pendulum" and "Designing a automatice vending machine".		
Topics/Schedule (授業計画)	1. Introduction – Birth and history of Mechatronics 2. Dynamics and Mechanics (How can we express a dynamics?) 3. Acutators – Principle of motor 4. Real-time control (1) ; Feedback control theory 5. Real-time control (2) ; Feedforward control theory 6. Real-time control (3) ; 2-degree of freedom control and Advanced control 7. Design a control system-Feedback control; Inverted pendulum 8. Sequence Control (1) ; Introduction 9. Sequence Control (2) ; Components 10. Sequence Control (3) ; Design logical circuits 11. Sequence Control (4) ; Design tools 12. Sequence Control (5) ; Design an automatic vending machine 13. Conponents of Mechatronics system (The above schedule will be carried out in 15 classes.)		
Evaluation/Grading Policy (成績評価方法)	A total of scores of exercises in each class are evaluated.		
Remarks (履修上の注意)	Nothing specifically.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	To prepare a distributed document that will be sent by e-mail before each class.		
Textbooks, References (教科書・参考書・資料)	The lecture will be given using the distributed documents(written in both Japanese and English). The references are specified in the class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Work Physiology System		
Lecturer(担当教員)	Kohji Hirakoba		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	Exercise is developed as the integration in physiological system related to muscle contraction. This course deals with the series of physiological reactions on structure and metabolism of muscle, and transport system associated with oxygen uptake and carbon dioxide output in respiratory and circulatory system during exercise. Moreover, this course also deals with the technological application of basic theory in work physiology system.		
Topics/Schedule (授業計画)	1 The mechanism in muscle contraction (structure in muscle and outline of muscle contraction) 2 The mechanism in muscle contraction (muscle contraction in more detail) 3 The mechanism in energy production and provision during exercise (anaerobic energy) 4 The mechanism in energy production and provision during exercise (aerobic energy) 5 Muscle fiber types (classfication of muscle fiber types) 6 Muscle fiber types (characteristics of contraction and metabolism in muscle fiber types) 7 Muscle fiber types (possibility of transfer in muscle fiber types due to exercise training) 8 The mechanism in muscle hypertrophy (genes in muscle growth factor and defence factor) 9 The transport of gases in blood (transport capacity and limiting factors in oxygen uptake) 10 The transport of gases in blood (transport capacity and limiting factors in carbon dioxide output) 11 Oxygen uptake kinetics during a constant work rate and the related controlling system in muscle energy production 12 Evaluation in oxygenation dynamics in a local exercising muscle by near infrared spectroscopy (NIRS) 13 Muscle fatigue (concept and definition of muscle fatigue) 14 Muscle fatigue (central and peripheral fatigue) 15 Muscle fatigue (mechanism attenuating peripheral fatigue due to buffering capacity		
Evaluation/Grading Policy (成績評価方法)	Your final grade will be assessed according to the following process: Usual performance score 30%, two reports 70% . To pass, students should earn at least 60 points of 100.		
Remarks (履修上の注意)	We highly recommend to prepare each lecture by reading reference books and to actively discuss the topics.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	The goals of this course are to (1) To understand the knowledge related to muscle contraction and direct energy necessary to muscle contraction, (2) To be able to explain classification of muscle fiber types and characteristics of muscle contraction and energy production system, (3) To be able to calculate three phases of oxygen uptake kinetics during a constant work rate, and to explain the physiological background of each phase of oxygen uptake kinetics, (4) To check a technological principle of NIRS, and to be able to describe oxygenation dynamics in exercising muscle due to NIRS, (5) To state the concrete main cause of muscle fatigue, (6) To understand the contribution rate of buffering capacity to peripheral fatigue.		
Textbooks, References (教科書・参考書・資料)	Textbook will be not used in this course, but students should read the following reference books. The materials necessary to each lecture will be provided. 1. Textbook of Work Physiology (edited by Astrand PO) 2. Outline of Exercise Physiology (edited by Asano K) 3. Essentials of Exercise Physiology (edited by McArdle WD, Katch FI and Katch VL)		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Photo-functional materials		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	1. Introduction of Photo-functional materials 2. Photocatalysis(1) Principle / water splitting 3. Photocatalysis(2) Organic decomposition / visible light response 4. Photocatalysis(3) Light-induced super-hydrophilicity / organic synthesis 5. Photocatalysis(4) Photocatalyst-particles / Co-catalyst loading 6. Photocatalysis(5) Physical and chemical propeties of particles 7. Photocatalysis(6) Semiconductor films 8. Photocatalysis(7) Semiconductor electrode 1 9. Photocatalysis(8) Semiconductor electrode 2 10. Solar cells (1) silicon 11. Solar cells (2) inorganic 12. Solar cells (3) organic 13. Luminescent materials and device 14. Photo-functional materials 15. Optical parts and optical apparatus		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class will be decided based on the following: Class attendance and attitude(40%) and Reports(60%)		
Remarks (履修上の注意)	This course will be taught in Japanese. But all of course materials are in English.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Students are expected to review after the lecture.		
Textbooks, References (教科書・参考書・資料)			
Language (使用言語)	Japanease		

Course Title（科目名）	Biofunctional molecular engineering		
Lecturer（担当教員）	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 Objectives/Outlines（目的・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 deasl with basis of biomolecular engineering using various types of biofunctional molecules. It also enhances to introduce the application of the technology with new topics.		
Topics/Schedule（授業計画）	1. Introduction 2. Genetic information of cell (Basic) 3. bioinformatic molecules (1) DNA 4. bioinformatic molecules (2) DNA 5. bioinformatic molecules (3) RNA 6. Amino acid, Peptide, and Protein (Basic) 7. Biofunctional molecules (1) Enzyme 8. Biofunctional molecules (2) Receptor 9. Biofunctional molecules (3) Antibody 10. Analysis the interaction of biofunctional molecules 11. Biofunctional molecules as a molecular recognition elements 12. Biosensor; analytical method by using biofunctional molecules 13. Application of nanomaterials in biotechnology 14. Biofunctional molecules with nanotechnoloy 15. Overview, Next-generation technology using biological functional molecules		
Evaluation/Grading Policy（成績評価方法）	Your overall grade in the class will be decided based on the following: Class attendance and mini-examination: 50% Term-end examination:50%		
Remarks（履修上の注意）	This course will be more or less demanding depending on the initial level in chemistry and biology.		
Expected preparation and review（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.		
Textbooks, References（教科書・参考書・資料）	No text book in this course. We provide the handout of each lecture.		
Language（使用言語）	This course will be taught in Japanse. But one of the course materials are in English. One English-spreaking teacheing assistant will be assigned to help non-Japanese students.		

Course Title（科目名）	Functional Interface Engineering		
Lecturer（担当教員）	Professor Tetsuya HARUYAMA, PhD		
Course intended for（対象学年）	1st year student		
Credit Category（単位区分）	Elective course	Credits（単位数）	2
Course Objectives/Outlines（目的・概要）	This lecture introduces the Functional Interface Engineering to study taking this lecture. the Functional Interface Engineering is an engineering academic field which includes chemistry, electrochemistry, molecular science, analytical chemistry: and physical chemistry.		
Topics/Schedule（授業計画）	1 General introduction of the Functional Interface Engineering 2 Electron and organic molecules 3 Element of electrochemical reactuon 1 4 Element of electrochemical reactuon 2 5 Element of catalytic electrochemical reaction 6 Electrochemical biosensors: Case study of R&D 7 Element of mammalian cell 8 Cultured cell based biosensors: Case study of R&D 9 Functional modulation of cellular function: Case study of R&D 10 Element of molecular functions 11 Functional Interface Engineering 12 Interigent materials 1: Case study of R&D 13 Interigent materials 2: Case study of R&D 14 Novel chemical reaction locus at gas/liquid interface: Case study of R6D 15 General summarize of the Functional Interface Engineering		
Evaluation/Grading Policy（成績評価方法）	Final grade of you will be decided accordong to quiz which is held in the every lecture		
Remarks（履修上の注意）	Prohibited voice recording, video recording and photographing.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Encourage volunteerism of every student		
Textbooks, References（教科書・参考書・資料）	Adviced in the Lecture		
Language（使用言語）	This lecture will be given in Japanese. If some one who would like to study as for the ″Functional Intwerface Engineering″. The issue will be conducted through an individual consultation		

Course Title(科目名)	Environmental Bio-adaptation		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	1 What is "Environmental Bio-adaptation"? 2 DNA and structure of chromosome DNA 3 DNA replication, repair, and gene mutation 4 Central Dogma 5 Gene expression 6 Regulation of gene expression 7 Translation —Messenger RNA to Protein— 8 Protein and enzyme and its catalytic mechanism 9 Protein evolution 10 Strategy of bacterial predation and cannibalism 11 Cell-to-cell communication and bacterial quorum sensing 12 Bacterial chemotaxis and other environmental adaptation by bacteria 13 Biodegradation of environmental pollutants and bioremediation 14 Reduction and utilization of Waste activated sludge 15 Future environmental biotechnology 16 Examination		
Evaluation/Grading Policy (成績評価方法)	Short test in each lecture and final examination		
Remarks (履修上の注意)	Nothing special		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Prior to the lecture, need to read lecture materials which can be available from the homepage of Dr. Maeda laboratory (http://www.life.kyutech.ac.jp/~toshi.maeda/). The password for the materials can be informed in the first lecture.		
Textbooks, References (教科書・参考書・資料)	Voet D., Voet J.G.; Biochemistry, 4th Edition		
Language (使用言語)	Usually lectures are given in Japanese. However we will have lecture in English on a different day if there are students who need explanation in English.		

Course Title(科目名)	Biochemical Zero-Emission		
Lecturer(担当教員)	Yoshihito Shirai		
Course intended for (対象学年)	1st semester		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	To indicate rational methodologies for recycling wastes to new resources and energy referring to biological and ecological functions. We consider about rational methods for recycling wastes to new resources and energy by referring to biological and ecological functions (metabolism, competition, symbiotic and parasitic relations, evolution). Then any suitable topics concerning waste recycles shall be provided to discuss with students.		
Topics/Schedule (授業計画)	1 Basic concept of this lecture 2 Chmical Recycling 3 Global Warming and Heat Island Effect 4 Power Geneation from Municipal Waste 5 Utilization of Wastes in Urban Area 6 Economy in Recycling 7 Reduction of Greenhouse Effect Gas and International Collaboration 8 Desertification and Renewable Energy 9 Zeroemission Society 10 A Scenario for the Zeroemission Society 11 A Critisism of Recycling 12 Recycling Sosiety turgeted in 21sr Century 13 Workshop 1 14 Workshop 2 15 Workshop 3 16 Workshop 4		
Evaluation/Grading Policy (成績評価方法)	Evaluation based on the results from workshop 1 – 4. Proposals of unique idea and solutions should be highly evaluated.		
Remarks (履修上の注意)	–		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Materials for the kecture can be downloaded from website「www.kyutech.ac.jp~shirai」. You can freely donwnload them and study in advance. Then after you can review them for the workshop.		
Textbooks, References (教科書・参考書・資料)	The materisals above		
Language (使用言語)	Usually Japanese, but English also avvailable in case.		

Course Title(科目名)	Biological Recycling		
Lecturer(担当教員)	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 Objectives/Outlines (目的・概要)	This course deals with the sustainability issues of biomass utilization.		
Topics/Schedule (授業計画)	1 Earth Structure and Biochemical Cycle 2 Ecosystem and Biochemical Cycle 3 Plant Biomass and Ecosystem 4 Ecological Connectivity and its Linkages with Human Activities 5 Biodiversity 6 Interrelationship between Ecosystems and Human Activities(Food) 7 Interrelationship between Ecosystems and Human Activities(Life Style) 8 Interrelationship between Local Ecosystems and Human Activitie 9 Interrelationship between Global Ecosystems and Human Activities 10 Essence of Global Environment Issues 11 Biomass Resources for Sustainable Society 12 Biomass Energy for Sustainable Society 13 Biomass Material for Sustainable Society 14 Biomass Utilization and Social System Design in Japan 15 Biomass Utilization and Social System Design of World		
Evaluation/Grading Policy (成績評価方法)	Grading will be decided based on attendance, reports, and a fraction of in-class contribution.		
Remarks (履修上の注意)	Basic knowledge about chemstry and biology are necessary.		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Will be introduced in the class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Eco-material Engineering		
Lecturer(担当教員)	Haruo Nishida		
Course intended for (対象学年)	1st year student		
Credit Category(単位区分)	Elective course	Credits(単位数)	2
Course Objectives/Outlines (目的・概要)	The shift in raw materials from fossil resources to renewable ones is gradually progressing in polymer field. Will the renewable resources-based bioplastics, namely, "Ecomaterials" replace fossil resources-based common plastics? Moreover, will the ecomaterials add more excellent properties and/or novel functions than the common plastics to become indispensable ones in our life? In this course, I want to discuss what kinds of materials will be necessary in a future based on many topics in academia and industry.		
Topics/Schedule (授業計画)	1 Introduction and summary of course 2 Current status and issues of fossil resources-based common plastics 3 Trends in polymer technologies and social circumstance 4 What is the Ecomaterials? 5 Synthesis of Ecomaterials 6 Structural properties of Ecomaterials 7 Processing and molding of Ecomaterials 8 Performance of Ecomaterials 9 Functions of Ecomaterials 10 Reactivity of Ecomaterials 11 Circulative utilization of Ecomaterials 12 Biodegradability of Ecomaterials 13 Environmental harmonization of Ecomaterials 14 Ecomaterials in a future 15 Comprehensive discussion		
Evaluation/Grading Policy (成績評価方法)	Evaluation is based on the stance on studying and reports. Particularly, original thought and ideas will be rated high.		
Remarks (履修上の注意)	Basic knowledge of polymer chemistry is necessary.		
Expected preparation and review (授業外学習(予習・復習)の指示)	Lecture materials are distributed as pdf files that have been downloaded and read through before the lecture. Checking the meanings of unknown technical terms is important.		
Textbooks, References (教科書・参考書・資料)	Printed materials are used and these are distributed as pdf files before the lecture.		
Language (使用言語)	Usually, the lecture is delivered in Japanese. Extra lecture will be delivered in English as necessary.		

Course Title(科目名)	Biorobotics		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	1. Overview of Biorobotics 2. Fundamentals of Robotics 3. Medical Robot I 4. Medical Robot II 5. Bio-inspired Robot I 6. Bio-inspired Robot II 7. Soft Robot I 8. Soft Robot II 9. Micro Robot I 10. Micro Robot II 11. Nano Robot I 12. Nano Robot II 13. Wet Robot I 14. Wet Robot II 15. Summary		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class will be decided based on short reports in each class and term-end examination.		
Remarks (履修上の注意)	Students should read handout distributed by PDF file in advance.		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Text books are not used. Handout is provided before each class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Materials Design		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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		
Evaluation/Grading Policy (成績評価方法)	Your final grade will be calculated according to the following process: Short examination (50%), and a fraction of in-class contribution		
Remarks (履修上の注意)			
Expected preparation and review (授業外学習 (予習・復習)の指示)	The students are expected to review all keywords presented in the class.		
Textbooks, References (教科書・参考書・資料)	Will be introduced in the class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Functional Biomaterials		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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		
Evaluation/Grading Policy (成績評価方法)	Midterm paper and final exam		
Remarks (履修上の注意)			
Expected preparation and review (授業外学習 (予習・復習)の指示)	Students should read English handout distributed by PDF file in advance.		
Textbooks, References (教科書・参考書・資料)	Textbook is not used. Reference book is as follows. 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		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Biomechanics		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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 repaired cases) Summary of Chapter 1 to Section 3.2 and research learning 4.1 Fundamentals of viscoelastic theory Individual investigation and presentation (Chapter 1 – Section 4.1) 4.2 Visoelasticity of soft tissues 4.3 Mechanical characteristics of skeletal muscles with active contaction 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)		
Evaluation/Grading Policy (成績評価方法)	Your overall grade in the class will be decided based on short reports in each class (40%) and presentations and reports of investigations (60%).		
Remarks (履修上の注意)	It is imortant to understand the mechanics. Basics of Newtonian mechanics, strangth of materials and continuum mechanics are explained in the class. Each short report should be submitted by the end of each class.		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Textbook: H. Yamada, Fundamentals of mechanics and biomechanics, in Jap (ISBN 978-4-339-07230-3) Materials are provided and references are introduced in each class.		
Language (使用言語)	Usually lectures are given in Japanese. However we will have lecture in English on a different day if there are students who need explanation in English.		

Course Title(科目名)	Biomechanical dynamics		
Lecturer(担当教員)	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 Objectives/Outlines (目的・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.		
Topics/Schedule (授業計画)	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)		
Evaluation/Grading Policy (成績評価方法)	Grading will be decided based on the following: - Quizzes in each class, - Final exam (or final paper).		
Remarks (履修上の注意)	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.		
Expected preparation and review (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.		
Textbooks, References (教科書・参考書・資料)	Text books are not used. References may be introduced. Materials are provided before each class.		
Language (使用言語)	Usually lectures are given in Japanese. However the teacher will explain individually to those students who need explanation in English.		

Course Title(科目名)	Research Workshop 2		
Lecturer(担当教員)	Chair of Technical Committee on Educational Affairs		
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 Objectives/Outlines (目的・概要)	Students will engage in revewing resaerch or related reaserch activities about the topic, which is not directly related to their PhD work, and they will aquire the advanced skills to propose engineering problems, logically analyze and solve them.		
Topics/Schedule (授業計画)	For 60 hours or longer in total, students will engage in revewing resaerch or related reaserch activities about the topic, which is not directly related to their PhD work, and they have to .submit a report of these activities on the project after completing them, and have a presentation.		
Evaluation/Grading Policy (成績評価方法)	The final grade will be determined by both the quality of report and the presentation on the project.		
Remarks (履修上の注意)	Students must gain approval from their supervising professors and discuss about the topic of project.		
Expected preparation and review (授業外学習 (予習・復習)の指示)	They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References (教科書・参考書・資料)	Textbooks or references may be assigned by supervisors.		
Language (使用言語)	Students can choose Japanese or English.		

Course Title（科目名）	Research Workshop 1		
Lecturer（担当教員）	Chair of Technical Committee on Educational Affairs		
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 Objectives/Outlines（目的・概要）	Students will engage in revewing resaerch or related reaserch activities about the topic, which is not directly related to their PhD work, and they will aquire the advanced skills to propose engineering problems, logically analyze and solve them.		
Topics/Schedule（授業計画）	For 60 hours or longer in total, students will engage in revewing resaerch or related reaserch activities about the topic, which is not directly related to their PhD work, and they have to .submit a report of these activities on the project after completing them, and have a presentation.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by both the quality of report and the presentation on the project.		
Remarks（履修上の注意）	Students must gain approval from their supervising professors and discuss about the topic of project.		
Expected preparation and review（授業外学習（予習・復習）の指示）	They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by supervisors.		
Language（使用言語）	Students can choose Japanese or English.		

Course Title（科目名）	International Extra-Mural Studies 2		
Lecturer（担当教員）	Professor in charge of International Internship		
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 Objectives/Outlines（目的・概要）	In order to foster the ability to communicate in a foreign language and acquire a global perspective which are required to become global engineers, students will engage in engineering internship at overseas universities, research institutes, or companies. Students will also need to foster the ablity to propose a research project and solve problems in it.		
Topics/Schedule（授業計画）	Students must engage in resaerch work or internship at overseas universities, research institutes, or companies for 60 hours or longer in total, and submit a report of the internship activities after completing the internship. An alternative reporting assignment may be given to students from overseas who cannot engage in engineering internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase overseas travelers' personal accident insurance and Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services). They should check the website for overseas safety of MOFA (Ministry of Foreign Affairs of Japan), and fully confirm the information for local safety risks of theft, infection, etc.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should prepare to explain their research contents and discuss it in English. They should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internships, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	English will be used.		

Course Title（科目名）	International Extra-Mural Studies 1		
Lecturer（担当教員）	Professor in charge of International Internship		
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 Objectives/Outlines（目的・概要）	In order to foster the ability to communicate in a foreign language and acquire a global perspective which are required to become global engineers, students will engage in engineering internship at overseas universities, research institutes, or companies. Students will also need to foster the ablity to propose a research project and solve problems in it.		
Topics/Schedule（授業計画）	Students must engage in resaerch work or internship at overseas universities, research institutes, or companies for 60 hours or longer in total, and submit a report of the internship activities after completing the internship. An alternative reporting assignment may be given to students from overseas who cannot engage in engineering internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase overseas travelers' personal accident insurance and Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services). They should check the website for overseas safety of MOFA (Ministry of Foreign Affairs of Japan), and fully confirm the information for local safety risks of theft, infection, etc.		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should prepare to explain their research contents and discuss it in English. They should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internships, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	English will be used.		

Course Title(科目名)	Domestic Extra-Mural Studies 2		
Lecturer(担当教員)	Professor in charge of Domestic Internship		
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 Objectives/Outlines (目的・概要)	In order to acquire the practical skills to logically analyze and solve engineering problems, and to understand the role engineers play in society, students will engage in internship at domestic companies, research institutes, or universities (other than Kyutech).		
Topics/Schedule (授業計画)	Students must engage in engineering internship at domestic companies, research institutes, or universities (other than Kyutech) for 60 hours or longer in total, and submit a report of the internship activities after completing the internship.		
Evaluation/Grading Policy (成績評価方法)	The final grade will be determined by the quality of report.		
Remarks (履修上の注意)	All students who engage in internship must gain approval from their supervising professors. They must purchase Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services).		
Expected preparation and review (授業外学習 (予習・復習)の指示)	Students should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internship, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References (教科書・参考書・資料)	Textbooks or references may be assigned by internship supervisors.		
Language (使用言語)	Language depends on organizations where students engage in internship.		

Course Title（科目名）	Domestic Extra-Mural Studies 1		
Lecturer（担当教員）	Professor in charge of Domestic Internship		
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 Objectives/Outlines（目的・概要）	In order to acquire the practical skills to logically analyze and solve engineering problems, and to understand the role engineers play in society, students will engage in internship at domestic companies, research institutes, or universities (other than Kyutech).		
Topics/Schedule（授業計画）	Students must engage in engineering internship at domestic companies, research institutes, or universities (other than Kyutech) for 60 hours or longer in total, and submit a report of the internship activities after completing the internship.		
Evaluation/Grading Policy（成績評価方法）	The final grade will be determined by the quality of report.		
Remarks（履修上の注意）	All students who engage in internship must gain approval from their supervising professors. They must purchase Liability Insurance coupled with PAS (Personal Accident Insurance for Students Pursuing Education and Research) of JEES (Japan Educational Exchanges and Services).		
Expected preparation and review（授業外学習（予習・復習）の指示）	Students should be familiar with the research and development activities of organizations where they engage in internship, and should research unfamiliar terms on the Internet. They should predict knowledge and skills necessary for internship, and prepare themselves using references. They should record their activities on a daily basis including reflection points and questionable points so that it can be used when making a report.		
Textbooks, References（教科書・参考書・資料）	Textbooks or references may be assigned by internship supervisors.		
Language（使用言語）	Language depends on organizations where students engage in internship.		