

	Code	Subject	Day/Period	Categories	Credit(s)	Instructor (Position)	Semester	Language Used in Course	Class Subject	Object and Summary of Class	Goal of Study	Contents and Progress Schedule of the Class
2017	CB22361	Sports A	Spring, Tue./2nd	Common Subjects-Health Sciences	1	Tetsuo ICHIGE 市毛 哲夫 Graduate School of Education	3	Japanese	Volleyball	Students will study various styles of communication, such as leadership and followership, and think about the relationship between sports and humans, while focusing on practice volleyball games.	Students will gain the minimal skills and knowledge (including judgment-related skills) needed to play a game of volleyball. Students will deepen their understanding of "competitiveness" and "cooperativeness" needed when playing games.	<ul style="list-style-type: none"> Review of basic skills needed, such as passing and receiving. Basic offensive techniques for setting up tossing and spiking Skills that lead from serving and receiving to tossing and spiking Skills that lead from blocking, spiking and receiving to attacking Practice through league-style games
2017	CB22362	Sports A	Spring, Tue./2nd	Common Subjects-Health Sciences	1	Taketo KAI 甲斐 健人 Graduate School of Education	3	Japanese	Soccer	In this class, students will deepen their understanding of soccer with regard to 1) positioning, and 2) ball control. As for the former, they will learn basic techniques for moving the ball. In regard to the latter, they will gain an understanding of competitiveness and strategy, with a focus on utilizing their teams. Students will improve their ability to enjoy soccer, each according to their level.	Provide students with an understanding of the athletic characteristics of soccer. Improve student skills in basic techniques. Foster the students' ability to improve team performance by taking advantage of their teammates' abilities.	1st Guidance 2nd Practice game 3rd-7th Exercises/games 8th-15th League tournament Pace will be adjusted depending on the students' performance level. Special attention will be given to improving performance in beginners. Exercises will incorporate the below elements, as appropriate to the students' level. Demonstrations, mainly by advanced students, will be performed. Moving the ball 1 (overview of kicking); moving the ball 2 (relationship between the legs and kicking); the importance of scoring in soccer; determining who should shoot; having the most suitable player shoot; game necessities: "demotion" is "promotion"; "dying" so your teammates can live; using time and space; team play 1 (learning your team's characteristics); team play 2 (playing to your strengths); team play 3 (building a game plan); team play 4 (responding to your opponents)
2017	CB22363	Sports A	Spring, Tue./2nd	Common Subjects-Health Sciences	1	Akira TAMAGAWA 玉川 明朗 Graduate School of Medicine	3	Japanese	Badminton	In this class, students will learn the importance of physical activity and how to exercise appropriately through badminton, a recreational sport with which many students are already familiar. Also, by playing competitively they will experience the importance of expressing intent and relating to and communicating with others. This will foster their initiative and cooperativeness. The class will be conducted so that anyone can take it, regardless of their level of physical fitness or badminton ability. By hitting the shuttlecock back and forth with various partners, I hope that students will learn not only the technical abilities needed to enjoy rallying, but also social skills. The class aims to teach students to enjoy sports activities, and feel confident about engaging in sports in their everyday lives. Badminton uses a shuttlecock. The word "shuttle" means "to come and go." The player hits the shuttlecock, which their partner then returns, so the player then must hit it back to the partner again. This is essentially a form of communication. Both beginners and experts are welcome in this class.	Students will come to enjoy exercising through actively participating in physical activities. All students will learn to enjoy rallying and matches without fear of making mistakes. Students will acquire enough skill to participate in doubles matches. In this class, "learning to play" and "technique" do not refer only to skill at hitting the shuttlecock with the racket. They also include playing badminton under various conditions while observing others, in addition to the ability for self-observation. They will learn about "intangibles" that cannot be taught in classroom lectures with the objective of obtaining "awareness" of the present moment.	1st Class, guidance 2nd What kind of sport is badminton? 3rd Making contact between shuttlecock and racket 4th Misc. strokes pt. 1 5th Misc. strokes pt. 2 6th Misc. strokes pt. 3 7th Misc. strokes pt. 4 8th Misc. strokes pt. 5 9th Misc. strokes pt. 6 10th Basic skills for enjoying doubles games pt. 1 11th Basic skills for enjoying doubles games pt. 2 12th Basic skills for enjoying doubles games pt. 3 13th Basic skills for enjoying doubles games pt. 4 14th Basic skills for enjoying doubles games pt. 5 15th Concluding remarks From the 2nd class on, content will be arranged based on assessment of the students' skill level. Also, 1 v. 1 (singles) and 2 v. 2 (doubles) practice will be conducted while learning stroke skills. Content of instruction may be changed depending on student proficiency. The pace of the class may also change depending on the speed at which the students progress.
2017	CB22364	Sports A	Spring, Tue./2nd	Common Subjects-Health Sciences	1	Akira SATO 佐藤 明 Graduate School of Medicine	3	Japanese	Kyudo (Japanese Archery – Rules of Shooting and Etiquette)	As many of the students will be studying Kyudo for the first time, they will learn the basics of handling the bow and arrows, and drawing and releasing the bow. Students will learn how the skills in Kyudo are based on a deep understanding of the mechanics of the human body and the characteristics of the equipment; in addition to learning how to hit a target, they will gain a rational and aesthetic understanding of the postures and movements.	Because Kyudo techniques and etiquette are very closely related, students will learn shooting techniques and correct movements in formalized situations. Shooting techniques are comprised of a systematic set of rules for handling the bow, while etiquette is composed of modes of traditional behavior. The goal of the class is to enable students to gain a scientific understanding of the rational postures/movements, and to learn to adapt their experiences into daily life.	Although learning shooting skills is the first priority, etiquette will also be learned step by step in each class as it is fundamental to posture and movement. Students will experience the fun and difficulties of Kyudo through games and competitions. 1. Guidance: Hazard prevention and safety measures. Summary of technique and etiquette 2. Introduction: Basics of shooting. Basics of standing posture 3. Holding the bow and gripping the string / two kinds of sitting posture ("Kiza," "Seiza") / three-breath-bowing 4. Principles of positioning the limbs (lower and upper body) / two kinds of bowing in sitting position ("Shikkenrei," "Sesshurei") / two-breath-bowing 5. Adjusting the body posture / the "Three Crosses" / two more kinds of bowing in sitting position ("Takushurei," "Soshurei") 6. Setting the grip on the bow to control it correctly ("Tenouchi") / one more kind of bowing in sitting position ("Goshurei") 7. The leather archery glove ("Yugake") and its usage / walking in Kyudo 8. "The Five Crosses" and determining correct shooting form / the "Five Crosses" / "Suriashi" -walking 9. Drawing the bow / main points of "Uchiokoshi" and "Hikiwake" / synchronization of breathing and movements 10. Obtaining full draw length / drawing until "Yazuka" / various types of body turn 11. Arms and trunk forming a cross ("Tateyokujumonji," "Hanare no Jumonji") / turning the body while walking 12. Tips for reliably hitting the target (the four requirements in "Tsumeara") / moving forward and backward while kneeling ("Shikko," "Shitta") 13. Important technical points about hitting or missing the target (vertical and horizontal "Nobia") / "Sonkyo" 14. The end of the shot (important aspects of "Zanshin") / synchronization of movements with breathing ("Ikiai") 15. Conclusion: Skill test - Hit 1m diameter target at a distance of 28m in the basic posture and movements

General_Education_Syllabus【FGL】 (2017 3rd and 4th semester classes)

Code	Subject	Evaluation Method	Textbook 1 - Textbook Title	Textbook 1 - Aurthur	Textbook 1 - Publisher	Textbook 1 - Publication Year	Textbook 1- ISBN/ISSN	Textbook 1 - Textbook/Refere nce	Textbook 2 - Textbook Title	Textbook 2 - Aurthur	Textbook 2 - Publisher	Textbook 2 - Publication Year	Textbook 2- ISBN/ISSN	Textbook 2 - Textbook/Refere nce	URL	Preparation and Review	In Addition
CB22361	Sports A	Attendance of the class is essential. Reports on themes not limited to volleyball, such as sport-related matters, may be required.														You need to manage your health for attending the class.	Students should pay close attention to the orientation and guidance on the first day of class.
CB22362	Sports A	Emphasis on practical training, attendance (70%). Group evaluations will also be given as each member's performance progresses (practical skills, understanding of strategy) (30%).															Take safety precautions, e.g. appropriate clothing, sufficient hydration, etc.
CB22363	Sports A	Needless to say, this class largely assumes participation as it is based on learning skills and practicing. On the 15th class there will be a lecture. A test may be given as well. Basically, the class will be graded as Pass - A (excellent) or Fail - D (poor).														It is necessary to investigate various information on sports. The details will be announced in class.	
CB22364	Sports A	Students must attend class, as learning the body movements requires practice. Grades will be based on attendance rate and skill tests. Students will take a practical examination, shooting 79cm diameter target at a distance of 28m, according to the rules of formal technique and etiquette.															Archery equipment will be provided by the university. Piercings and other accessories must be removed before class. For safety reasons, please do not wear earrings or other accessories.

	Code	Subject	Day/Period	Categories	Credit(s)	Instructor (Position)	Semester	Language Used in Course	Class Subject	Object and Summary of Class	Goal of Study	Contents and Progress Schedule of the Class
2017	CB22365	Sports A	Spring, Tue./2nd	Common Subjects-Health Sciences	1	Toshihiko FUJIMOTO 藤本 敏彦 Institute for Excellence in Higher Education	3	Japanese	Softball	Changes in the social environment and lifestyles have lead to a decrease in opportunities for exercise, lowered physical fitness, and an increase in lifestyle-related illnesses and stress. Students will gain an understanding of the basic knowledge and physical attainment necessary for health and physical fitness within university life, taking into account changes they will experience in their exercise patterns and daily routines after entering university. Students will attain physical fitness by actually playing a lifetime sport, improve their abilities and communication skills, and learn life skills that will help them lead full lives as students.	1) (Knowledge/Thought) • Goals and methods will be taught for maintaining/improving health and physical fitness 2) (Technique/Expression) • Specific exercise methods will be implemented to familiarize students with sports and maintain/improve health and physical fitness 3) (Motivation/Interest/Attitude) • Students will be able to engage in sports independently while having enjoyable experiences and communicating.	The first class will consist of guidance. A physical fitness test will be performed in the second class. Following this, students will work towards realizing their athletic potential through softball during the first part of the term. During the second part of the term, they will engage in a training program to obtain the strength and mobility necessary for maintaining and improving health. Another physical fitness test will be performed in the 14th class, and the 15th class will consist of an overall review (general test and review of individual physical changes). Class 1: Guidance (selection of issues, class outline, things to be aware of) Class 2: Physical fitness test Class 3: Softball (group learning, variations of catch, fielding practice) Class 4: Softball (group learning, variations of catch, hitting practice) Class 5: Softball (group learning, catch, practice game) Class 6: Softball (group learning, catch, practice game/checking fielding positions) Class 7: Softball (group learning, catch, practice game/anticipating the next play) Class 8: Softball (group learning, catch, practice game/anticipating the next play) Class 9: Softball (group learning, catch, practice game/review) Class 10: Softball (group learning, catch, practice game/review) Class 11: Softball (test: catch, game) Class 12: Fundamentals of strength and mobility building (waiking) Class 13: Fundamentals of strength and mobility building (stretching) Class 14: Physical fitness test Class 15: Overall review (general test and review) In case of bad weather, "Physical Training and Exercise" will be substituted for "Softball."
2017	CB22367	Biology B	Spring, Tue./2nd	Expansion Subjects-Biology	2	ROBERT, Martin Institute for Excellence in Higher Education	3	English	Essential Biochemistry	Biochemistry is a vast field that covers the structure, function, and interconversion of the biomolecules that characterize living systems. The main objective of this course is for the student to acquire a fundamental understanding about biomolecules, proteins, enzymes and catalysis as well as a mastery of the main central metabolic pathways.	After this course the student will have a solid grasp of the basic biochemical components and functions that are essential to maintain cellular life. The student will also better realize the importance of studying cellular biochemistry in order to understand the principles behind the constant self-maintenance and regenerating activities that characterize cellular processes and how they are related to health and diseases. Some of the specific learning objectives include: - Functionally categorize the main type of biomolecules including carbohydrates, amino acids and proteins, lipids, nucleotides, and nucleic acids - Describe the different levels of protein structure and their connections with protein function - Explain principles of enzyme activity and catalysis - Understand the fundamental role of central carbon and energy metabolism in living systems - Appreciate the larger picture view and the connectivity among all these biomolecules and pathways To achieve this, students will complete weekly reading and problem set assignments for the units listed below. Quizzes, in-class group activities and exercises, and an online forum will enhance interactions and student learning. In addition to those activities, a mid-term and final exam will be used to evaluate student learning and ability to recognize the structure-function link in biomolecules as well as the student ability to extend what they learned in novel contexts.	1) Introduction to biochemistry: Foundations and historical perspective 2) The chemical bond. Water and basic biological chemistry 3) Biomolecules (carbohydrates and lipids) 4) Biomolecules (amino acids, peptides, and proteins, nucleotides and nucleic acids) 5) Enzymes and catalysis (reaction mechanisms and kinetics) 6) Protein structure and function - 1 7) Protein structure and function - 2 8) Mid-term examination. Membrane structure (lipid bilayer and membrane proteins) 9) Basic metabolism overview: principles of cellular energy conversion. Glycolysis, gluconeogenesis, and the pentose phosphate pathway 10) The tricarboxylic acid (TCA) cycle and the glyoxylate pathway 11) Cellular respiration and fermentation pathways 12) The electron transport chain and oxidative phosphorylation 13) Photosynthesis 14) Analysis of biomolecules and metabolic function. Proteomics and metabolomics 15) Final examination
2017	CB24359	Calculus B	Spring, Tue./4th	Expansion Subjects-Mathematics	2	TRUSHIN, Igor Institute for Excellence in Higher Education	3	English	Calculus of function of two variables	The purpose of this class is to learn the notions of derivative and integral of function of two variables	One should understand meaning of partial and total differentiations, double integrals, master the basic techniques and applications which accompany them	1.Geometry of the plane 2.Limits of functions of two variables 3.Continuous functions of two variables 4.Partial derivatives and total differential 5.Jacobian and chain rule 6.Higher order partial derivatives 7.Taylor's theorem 8.Applications of derivatives, relative and absolute extrema. 9.Implicit function 10.Double integrals 11.Iterated integrals 12.Improper double integrals 13-14.Change of variables in double integrals 15.Final examination
2017	CB25301	Basic Japanese 2	Spring, Tue./5th, Wed./2nd, Thu./5th	Common Subjects-Subjects for International Students	3	Natue SUGAYA, Kei YOSHIMOTO 菅谷 奈津恵, 吉本 啓 Institute for Excellence in Higher Education	3	English	Japanese for advanced beginners	Intended for students who have studied Japanese for around 150 hours. This class aims to help students acquire basic knowledge of Japanese language and enhance the four skills of speaking, listening, reading, and writing.	Students will - master basic Japanese grammar, vocabulary and approximately 150 new kanji. - be able to express themselves in both spoken and written forms at a level necessary for simple daily university student life. - achieve a proficiency level equivalent to JLPT N4.	1. Course orientation 2-6. Lesson 13 Potential form 7-11. Lesson 14 Giving/receiving verbs (ageru/kureru/morau) 12-16. Lesson 15 Volitional form 17-21. Lesson 16 Giving/receiving subsidiary verbs (-te ageru/-te kureru/-te morau) 22. Midterm exam (Katakana, Kanji, Grammar, Listening) 23-27. Lesson 17 Reporting expressions 28-32. Lesson 18 Transitive/intransitive verbs 33-37. Lesson 19 Respectful expressions 38-43. Lesson 20 Humble expressions 44-45. Summary

General_Education_Syllabus【FGL】 (2017 3rd and 4th semester classes)

Code	Subject	Evaluation Method	Textbook 1 - Textbook Title	Textbook 1 - Author	Textbook 1 - Publisher	Textbook 1 - Publication Year	Textbook 1 - ISBN/ISSN	Textbook 1 - Textbook/Reference	Textbook 2 - Textbook Title	Textbook 2 - Author	Textbook 2 - Publisher	Textbook 2 - Publication Year	Textbook 2 - ISBN/ISSN	Textbook 2 - Textbook/Reference	URL	Preparation and Review	In Addition
CB22365	Sports A	Students will be evaluated with respect to attainment of goals. These are classified as follows: Goal 1 (Knowledge) 10%, Goal 2 (Technique) 20%, Goal 3 (Attitude/Consistent Performance) 70%. Methods for evaluating each goal are as follows. -Goal 1: Evaluation of knowledge regarding physical training, general test -Goal 2: Evaluation of technique during developmental exercises (catch) -Goal 3: Evaluation of behavior during class learning activities Warning: -Refusal to follow instructions without a valid reason, or making disparaging comments in class, will result in a large grade penalty. -Students who, even once, leave class early without permission or ask other students answer roll call for them etc. will not receive credit for the class. -Students who forget their gym clothes 3 times or more will receive a large grade penalty.														Recording the number of steps on every day and about voluntarily exercise (time, strength, item etc...) once a week except this class. It includes in the evaluation.	<ul style="list-style-type: none"> Attitude in class (please participate actively) Considerations will be made for students who have to attend official functions (e.g. tournaments for their club activities etc.) This class is aimed at beginners. Students need not bring any equipment. Students should wear clothes and shoes appropriate for exercising. Details will be given during the guidance class.
CB22367	Biology B	Attendance and active participation (20%), weekly exercises and assignments (30%), examinations (50%).	Essential Cell Biology	Alberts B, Bray D, Lewis J, Raff M, Walter P, Hopkin K, Johnson A, Roberts K	Garland Science	2012			Lehninger Principles of Biochemistry	Nelson DL, Cox MM	Freeman	2004			Students will be expected to spend 1-2 hours per week, on average, reading relevant textbook material and completing assignments.	<p>1) This is a general entry-level course open to all students and it is compulsory for FGL-AMB program students. Together with Biology A (Essential Cell Biology), this course provides a basic introduction to modern biochemistry and molecular cell biology. High school level familiarity with basic organic chemistry and biology is assumed. Japanese students and exchange students from any field of study are encouraged to enroll, knowing that this is an introductory course that is held completely in English.</p> <p>2) Alberts' Essential Cell Biology, 3rd and 4th Edition, will be the main reference and several copies of the text will be available for loan at the FGL office. It is an entry-level textbook that comes with a useful DVD.</p> <p>3) Instructor available for questions and consultation during office hours, Thursday 10:00-12:00, and by e-mail (mrobert@m.tohoku.ac.jp).</p>	
CB24359	Calculus B	Evaluation will be based on results of a tests and home work	Calculus: An intuitive and Physical Approach	Morris Kline	Dover Publications		978-048640453-0									Review thoroughly by doing homework assignments.	
CB25301	Basic Japanese 2	1. Exams (Midterm: Katakana, Kanji, Grammar, Listening; Final: Katakana, Kanji, Grammar, Listening, Writing, Speaking) 60%. 2. Quizzes (Kanji, vocabulary, grammar) 20% 3. Homework 10% 4. Class participation 10%	Genki 2, second edition	Banno et al.	The Japan Times	2011	978-4-7890-1443-4	Textbook	Genki 2 Workbook, second edition	Banno et al.	The Japan Times	2011	978-4-7890-1444-1	Textbook	Genki-Online http://genki.japan-times.co.jp/index_en	During the course we expect you to: 1. Submit all homework assignments by due dates. Late work will be marked lower. 2. Prepare for the lessons: Listen CD and learn vocabulary in advance. Read the grammar explanations in advance.	

	Code	Subject	Day/Period	Categories	Credit(s)	Instructor (Position)	Semester	Language Used in Course	Class Subject	Object and Summary of Class	Goal of Study	Contents and Progress Schedule of the Class
2017	CB31341	Physics C	Spring, Wed./1st	Expansion Subjects-Physics	2	Takeshi KOIKE 小池 武志 Institute for Excellence in Higher Education	3	English	Electromagnetism	Electromagnetic phenomena are abundant in our daily lives from electricity (volts, amperes, watts, etc.) we use every day, magnets on our refrigerator, to all lights surrounding us. The vastness and complexity of this interesting subject results from only four equations, the Maxwell's equations. In this course, they shall be the starting and ending point. Our goal is to appreciate and understand various manifestations of these four equations by studying electric and magnetic forces and interactions between them.	By the end of the course, you are expected to gain familiarity with and obtain basic understandings of Coulomb's Law, electric fields, Gauss' Law, electric potential, capacitance, circuits, magnetic forces and fields, Ampere's law, induction, and electromagnetic waves, and how they are all connected through the Maxwell equations.	Schedule of the course: 1. Overview, Maxwell's Equations, Vectors 2. Electric Charge, Electric Force (Coulomb's Law), Electric Field 3. Electric Flux, Gauss's law 4. Electric Potential 5. Capacitance 6. Current, Resistance, DC Circuits, Kirchhoff's Law 7. RC Circuits 8. Charges and Currents in Magnetic Fields 9. Sources of Magnetic Field, The Biot-Savart Law, Amperes Law 10. Faraday's Law of Induction 11. Midterm Examination (contents of 1-7) 12. Inductance and RL Circuits 13. LC and LCR Circuits 14. Maxwell equations and electromagnetic waves 15. Review and Summary 16. Final Examination
2017	CB33334	Chemistry C	Spring, Wed./3rd	Expansion Subjects-Chemistry	2	ZHANPEISOV, Nurbosyn Institute for Excellence in Higher Education	3	English	Fundamentals of basic organic chemistry	The nature of carbon and its chemical bonding is the fundamental concept in organic chemistry. One will learn diversity of organic molecular associations and compounds, the nature and types of electronic transitions defined by physical methods in organic chemistry as well as basic principles of various organic syntheses.	One must understand different ways to image organic molecules and compounds, their molecular, structural as well as electronic formulas. Basic principles of IUPAC nomenclature, the basic rules of making names and the structure of organic matter will be the main goal to understand their relationship to chemical and physical properties of any organic compounds. One will learn the concept of intermediates or formations, electronic effects of a different substituent and their influence on the stability and chemical reactivity. One must understand also the nature of bonding responsible for formation of organic molecular associations.	1. Hybridization of carbon and types of chemical bonds in organic compounds 2. Electronic effects of substituent, intermediates, bond break 3. Acids and bases (Bronsted, Lewis, Conjugate), effect of substituent 4. Saturated hydrocarbon (alkane): natural resources and chemical properties 5. Unsaturated hydrocarbon (alkene): the nature of double bond and isomerism 6. Unsaturated hydrocarbon (alkyne): C-H group acidity 7. Dienes: Stereochemistry and its application in organic synthesis 8. Nucleophilic substitution at saturated carbon atom 9. Mid-term test 10. Alcohols and ethers 11. Aromatics: five- and six-membered organic substances 12. Aromaticity and anti-aromaticity 13. Aldehydes and ketones: industrial production of HCOH and CH3COH 14. Carboxylic acids: physical and chemical properties 15. Term-end test
2017	CB34338	Biology C	Spring, Wed./4th	Expansion Subjects-Biology	2	ROBERT, Martin Institute for Excellence in Higher Education	3	English	Elements of Physiology and Systems biology: Integrative and systems principles in biology	The main objective of the course is to convey basic principles of physiology and systems thinking about biological systems, from the molecular to organismal level. Principles and mechanisms that govern homeostasis and organization in living organisms will be emphasized. Physiology, the study of the functions of biological systems is more relevant than ever. Its principles established the foundations for the newer field of systems biology in which, among other approaches, large-scale experimental approaches generate quantitative data about biomolecules or phenotypes at an unprecedented pace and scale. Along with these advances, computational and mathematical modeling approaches have become essential to deal with the huge amount of data and to better understand complex and dynamical systems. Awareness about systems principles is therefore important for the next generation of science and engineering leaders in a world where inter-disciplinary research is key. This introduction to physiology and systems biology will therefore be of interest to students in biology, physics, chemistry, and engineering by forming a common thread applicable in various fields.	After this course the student will better appreciate how living systems are made of a huge number of interacting components and how functionality emerges from their dynamic and tightly regulated interactions at multiple scales. Some of the specific learning objectives include: - Appreciate the multi-scale organization of living systems and how they give rise to complex and emergent functions - Describe examples of complex and emergent function and properties - Recognize the limits of reductionist approaches - Understand some of the essential principles of systems theory and organization as well as principles of engineering that are applicable in biology - Understand basic network structures, interactions, and their dynamics - Appreciate the power of modeling to study complex biological systems To achieve this, students will complete weekly reading and problem set assignments for the units listed below. Quizzes, in-class group activities and exercises, and an online forum will enhance interactions and student learning. In addition to those activities, a mid-term and final examination will be used to evaluate student learning.	1)Introduction: Basic cell physiology and systems biology 2)Multi-level system organization: cellular, tissue, organ, and organism level 3)Principles of physiology and systems biology and examples 4)Systems at work: the heart, endocrine system, immune system, circadian clock, etc. 5)Homeostasis and robustness. Reductionism and emergence. 6)Principles of control theory (networks and feedback) 7)Complex systems and dynamical systems. Universality and scaling in biology 8)Mid-term examination Examples of spatio-temporal pattern formation and simulation 9)The systems biology cycle and modeling in biology: molecular, metabolic, cellular, or population models 10)High-throughput experimental methods (omics) 11) Noise and heterogeneity in biological systems 12) A brief synthetic biology outlook 13) Projects 1 14) Projects 2 15) Final examination
2017	CB35320	History	Spring, Wed./5th	Expansion Subjects-Human Sciences	2	Mitsuru HAGA 芳賀 満 Institute for Excellence in Higher Education	3	English	History of Art in Ancient Eurasia ~ Diffusion of Classical Greek Art into Central Asia	Art is the way we comprehend and understand this Universe. Therefore Art should be regarded as a visual philosophy; not as a mere illustration of history based on written documents. Thus, the importance of understanding Art history, in this case, History of Art in Ancient Eurasian, can never be exaggerated. First, students will engage with Ancient Greek Art from its beginning to the Hellenistic Age. Then students will be introduced to Buddhist Art of pre-iconic phases in India and Central Asia. After examining Alexander the Great's campaign in the East, students will learn its consequences reflected in Art in Hellenistic Kingdoms and in Central Asia. In this framework, Buddhist Art of the iconic phase will be treated. The teacher will explain results of his excavation of a Greco-Kushan city, Kampyr-tepa, along the "Silk Roads" by the Amu Darya (Oxus River) running between Uzbekistan and Afghanistan. Finally students will learn how Buddhism and Buddhist Art diffused into China.	Students will obtain basic knowledge of Classical Greek Art and Buddhist Art, and also come to understand the diffusion of Classical Greek and Roman Art in Eurasia. And hopefully students will gain another new point of view, which is not Euro-centric nor Sino-centric, but Eurasia-centric.	1. Introduction 2. Ancient Egyptian Art as an influence source on Greek Art 3. Ancient Greek Art : Before the Archaic Age 4. Ancient Greek Art : The Archaic Age 5. Ancient Greek Art : The Classic Age 6. Ancient Greek Art : The Hellenistic Age (1) 7. Ancient Greek Art : The Hellenistic Age (2) 8. Life of Gautama Buddha seen through Art 9. Buddhist Art in the pre-iconic phase: From the 5th Century B.C. 10. Buddhist Art in the iconic phase: Up to the 2nd Century A.D. 11. Art in Parthian and Greco-Bactrian Kingdom 12. Results of excavation in Kampyr-tepa in Uzbekistan 13. Questions of King Milinda - dialogue between Indo-Greek King Meander and Buddhist Priest Nagasena 14. Diffusion of Buddhism and Buddhist Art into East (1) 15. Diffusion of Buddhism and Buddhist Art into East (2)

General_Education_Syllabus【FGL】 (2017 3rd and 4th semester classes)

Code	Subject	Evaluation Method	Textbook 1 - Textbook Title	Textbook 1 - Aurthur	Textbook 1 - Publisher	Textbook 1 - Publication Year	Textbook 1 - ISBN/ISSN	Textbook 1 - Textbook/Reference	Textbook 2 - Textbook Title	Textbook 2 - Aurthur	Textbook 2 - Publisher	Textbook 2 - Publication Year	Textbook 2 - ISBN/ISSN	Textbook 2 - Textbook/Reference	URL	Preparation and Review	In Addition
CB31341	Physics C	Evaluation will be based on a midterm exam (40%), final exam (40%), homework assignments (10%), attendance (10%). Extra points may be given for writing a report on selected topics.	University physics Vol. II 13th edition	Young and Freedman	Addison-Wesley	2011	9780321751218	reference								Understanding of basic and important notions encountered in Physics A (classical mechanics) is required for this course. Knowledges of vector analysis are desirable. Problem solving and discussion with the classmates after the class are highly recommended and encouraged.	Additional references and recommended readings will be given in the class. For those students enrolled in Physics B at the same time, some contents of Physics B (oscillations and waves) will be taught to help understand electromagnetic waves in this course. For contact mailto: takeshi.koike.b6@tohoku.ac.jp
CB33334	Chemistry C	Evaluation will be based on class attendance, reports and on the results of a term-end test.	Organic Chemistry	John McMurry		2007			Organic Chemistry	R. Morrison and R. Boyd		1997				We will have small quizzes, mid-term and term-end tests.	The lecture attendance will be strictly controlled.
CB34338	Biology C	Attendance and active participation (10%), exercises and assignments (30%), mid-term and final examinations (40%), project (20%).	An Introduction to Complex Systems Biology	Kaneko K	Springer	2006										Students will be expected to spend 1-2 hours per week, on average, reading relevant textbook material and completing assignments.	1) This is a general, entry level course with no pre-requisite although it assumes high-school level basic biology and mathematical skills. The course is open to all students and is compulsory for FGL students in the AMB program. Japanese students and exchange students from any field of study are also encouraged to enroll, knowing that this is an introductory course that is held completely in English. 2) Instructor available for questions and consultation during office hours, Thursday 10:00-12:00, and by e-mail (mrobert@m.tohoku.ac.jp).
CB35320	History	Evaluation will be based on attendance and performance in the classroom (30%) and final report (70%).	The Crossroads of Asia: Transformation in Image and Symbol in the Art of Ancient Afghanistan and Pakistan	E. Errington and J. Cribb (eds.)	Cambridge UP	1992	0-95183991-8		The Diffusion of Classical Art in Antiquity	J. Boardman	London	1994	0-50023696-8			The session time is limited and therefore self-directed learning is important. Students are required to prepare and review for each class.	

	Code	Subject	Day/Period	Categories	Credit(s)	Instructor (Position)	Semester	Language Used in Course	Class Subject	Object and Summary of Class	Goal of Study	Contents and Progress Schedule of the Class
2017	CB42326	Physics B	Spring, Thu./2nd	Expansion Subjects-Physics	2	Takeshi KOIKE 小池 武志 Institute for Excellence in Higher Education	3	English	Oscillations, waves, propagation of waves in media, stress and strain, fluid dynamics	In the first part of this course, we will study oscillatory motions and properties of waves propagating through different medium such as a string, air, and vacuum. In the second part, properties and dynamics of more realistic material than that of a perfectly rigid object in response to forces will be studied.	By the end of the course, you are expected to gain familiarity with and obtain basic understandings of oscillation phenomena which include the simple motion of a pendulum and propagation of waves and their basic properties. Mechanism behind the standing waves, sound waves, beats, the Doppler effect, and shock waves should become clear. In addition, you are expected to be familiar with how a non-rigid body or a collection of particles such as fluids responds to forces.	Schedule of the course: 1. Oscillations: Simple Harmonic Motion 2. An Angular Simple Harmonic Motion: Pendulums 3. Damped Simple Harmonic Oscillations 4. Forced Oscillations and Resonances 5. Waves and Their properties: Transverse & Longitudinal Wave, Wave Length, Frequency, and Speed, The Wave Equation 6. Superposition Principle of Waves, Wave Interferences, Standing Waves, 7. Sound Waves: speed of sound, intensity and sound level, standing sound waves 8. Beats, The Doppler Effect, Shock Waves 9. Equilibrium, The Center of Gravity, 10. Midterm Review and Summary 11. Midterm Examination (contents of 1-7) 12. Stress, Strain, Elasticity 13. Static Fluids: density, pressure, and buoyancy 14. Fluid Dynamics: the continuity equation, Bernoulli's equation 15. Review and Summary 16. Final Examination
2017	CB43361	Introductory Science Experiments	Spring, Thu./3rd,4th	Expansion Subjects-Scientific Experiments	2	Norihiro NAKAMURA ,etc 中村 教博, 他 Institute for Excellence in Higher Education	3	English	Introductory Science Experiments	This course is intended to aid students in thinking logically and to understand fundamental concepts of natural phenomena.	The students carry out fundamental experiments by themselves and think logically. The experiments are combined physics, chemistry, biology and earth sciences and set up a five themed course entitled "Life", "Energy", "Earth and Environment", "Materials", and "Science and Culture".	#1 Guidance will be given to provide you how to learn science experiments and how to write a scientific report. Perform one subject in a week and submit your report by next week. Theme: Earth and Environment #2 Environmental Radioactivity (Subject 1) #3 Quality of Water in the Hirose River (Subject 2) #4 Gravity on Earth (Subject 3) Theme: Materials #5 Electrical resistivity (Subject 4) #6 Synthesis and characterization of conductive polymers (Subject 5) #7 Synthesis of organic compounds (Subject 6) #8 Question and answer about experiments that you have done Theme: Energy #9 Atomic spectra and solar cells (Subject 7) #10 Fuel cells (Theme 8) Theme: Science and Culture #11 Vibrational modes of strings and music (Subject 9) Theme: Life #12 Cells and DNA (Subject 10) #13 Detection of the differences in genomic DNA sequences from different animals (Subject 11) #14 Physics of biopolymers (DNA) (Subject 12) #15 Question and answer about whole experiments that you have done. #16 Question and answer about this course
2017	CB52320	Linear Algebra B	Spring, Fri./2nd	Expansion Subjects-Mathematics	2	TRUSHIN, Igor Institute for Excellence in Higher Education	3	English	Basics of linear algebra	The purpose of this class is to learn the basic notions and properties of linear mappings, eigenvalues and eigenvectors	One should understand the meaning of linear mappings and be able to calculate eigenvalues, eigenvectors, to diagonalize matrices	1.Linear mappings 2.Matrix expressions of linear mappings 3.Eigenvalues and eigenvectors 4.Diagonalization of matrix 5.Cayley-Hamilton theorem 6.Triangulation of matrix (Jordan canonical form) 7.Scalar product and norms of vectors 8.Orthonormal system of vectors 9.Schwarz inequality and angle between two vectors 10.Orthogonal matrix and Gram-Schmit orthogonalization process 11.Hermitian matrix and diagonalization. 12.Real quadratic forms 13-14.Unitary matrix and complex quadratic form 15.Final examination

General_Education_Syllabus【FGL】 (2017 3rd and 4th semester classes)

Code	Subject	Evaluation Method	Textbook 1 - Textbook Title	Textbook 1 - Aurthur	Textbook 1 - Publisher	Textbook 1 - Publication Year	Textbook 1- ISBN/ISSN	Textbook 1 - Textbook/Refere nce	Textbook 2 - Textbook Title	Textbook 2 - Aurthur	Textbook 2 - Publisher	Textbook 2 - Publication Year	Textbook 2- ISBN/ISSN	Textbook 2 - Textbook/Refere nce	URL	Preparation and Review	In Addition
CB42326	Physics B	Evaluation will be based on a midterm exam (40%), final exam (40%), homework assignments (10%), attendance (10%). Extra points may be given for writing a report on slected topics.	University Physics Vol. I 13th edition	Young and Freedman	PEARSON	2011	9780321733382	reference								Basic concepts and knowledges learned in classical mechanics (Physics A) are essential to understand various physical phnemea encountered in this course.	The reference given above will be used as a guide for the course. More references and suggested readings will be introduced during lectures. Everyone is encouraged to drop by during office hours at least once or by appointment. Contact: takeshi.koike.b6@tohoku.ac.jp
CB43361	Introductory Science Experiments	The credit will be given as a result of the evaluation for both the attendance to each subject class and the submission of report papers of each subject in classes.	Textbook for Introductory Science Experiments						Login your ISTU to see PPT files of each experiment							You are strongly encouraged to read each chapter in the text for the Introductory Science Experiments before each experiment. After each experiment, your own scientific report should be prepared in a week (by next experiment).	The textbook for Introductory Science Experiments is distributed to students at the beginning of the class. Questions about this class: please send an e-mail to t-jikken@he.tohoku.ac.jp.
CB52320	Linear Algebra B	Evaluation will be based on results of a tests and home work	Introduction to Linear Algebra.	Serge Lang	Springer.		0387962050									. Review thoroughly by doing homework assignments.	

	Code	Subject	Day/Period	Categories	Credit(s)	Instructor (Position)	Semester	Language Used in Course	Class Subject	Object and Summary of Class	Goal of Study	Contents and Progress Schedule of the Class
2017	CB21442	Calculus C	Fall, Tue./1st	Expansion Subjects-Mathematics	2	HANSEN, Frank Institute for Excellence in Higher Education	4	English	Calculus C (ordinary differential equations)	1. Academic aims: Introduction to the theory of ordinary differential equations. 2. Outline of lectures: Theory and practice of ordinary differential equations.	Goal: To understand the theory of ordinary differential equations and learn how to solve elementary ordinary differential equations.	1. Ordinary differential equations and the first order ODE. 2. Existence and uniqueness of solutions. 3. Linear differential equations. 4. Bernoulli's ODE, the second order ODE. 5. Second order linear differential equation. The guessing method. 6. Exercises on the blackboard. 7. Systems of linear differential equations. 8. Matrix exponentials, higher order linear differential equations. 9. Solving ODEs by power series. 10. One hour mid-term test, exercises. 11. Legendre's differential equation. 12. The Laplace transform and the solution of linear ODEs. 13. Newton's equation, Hamiltonian mechanics and the mathematical pendulum. 14. Summary of the course and exercises. 15. Examination.
2017	CB22401	Intermediate Japanese	Fall, Tue./2nd, Tue./3rd, Wed./1st	Common Subjects-Subjects for International Students	3	Atsuko Uchiyama Yukari AZUMI 内山 敦子 安住 ゆかり	4	English	Intermediate Japanese	Intended for students who have studied Japanese for around 300 hours and have mastered basic-level Japanese: equivalent to JLPT N4 level. This class aims to develop vocabulary, grammatical structures and expressions further, and trains students in the four skills of speaking, listening, reading and writing so that they can deal in Japanese with practical matters in their academic as well as social life.	1. Students who completed this course will attain approximately JLPT N3 level. 2. Students will be able to - comprehend slightly complicated, yet familiar topics through a series of texts - comprehend daily conversations on various topics - write short sentence with minimum basic structure - provide information and state their opinions in an appropriate manner	I Speech class (Tues.2) 1) organize oral speeches with basic structure and applied more complicated structure 2) exchange information and opinions based on the delivered speech in class 3) expand vocabulary Oct.~Nov. "My country" (Festival, Event, Food, History and etc.) Dec.~Jan. "My culture and your culture" Jan. Interview project "My future plan" II Reading comprehension and vocabulary (Tues.3) 1) read various sentences, ranging from practical daily ones to those which are a little more difficult Ex. 「gesture」 「common sense」 「Japanese manners」 「Japanese idiomatic phrase」 2) learn the JLPT Level N3 vocabulary through studying its usage in different situations Ex. 「cooking」 「shopping」 「E-mail」 「schedule」 「body condition」 III Grammar class (Wed.1) 1) review the basic grammar -Honorific expressions -Polite form and Plain form -Style of sentence -Giving and receiving -Potential form -Particles etc. 2) practice new forms and expressions -Passive form -Causative form -Causative-passive form -Additional expressions equivalent to JLPT N3 level
2017	CB32420	Probability & Statistics	Fall, Wed./2nd	Expansion Subjects-Mathematics	2	HANSEN, Frank Institute for Excellence in Higher Education	4	English	Probability and Statistics	1. Academic Aims: An introduction to the theory of probability theory and statistics. 2. Keywords: Probability theory, random variables, distributions, the central limit theorem, sampling and estimation, statistical inference.	Goal: To understand the fundamental notions of probability and statistics; to obtain knowledge of important distributions, and to master statistical estimation and statistical hypothesis testing in simple cases.	1. State and sample space, events, probability, independence. 2. Measure and probability, stochastic variables and independence. 3. Distributions, stochastic vectors and independence, expectation for discrete and continuous variables. 4. Variance, higher moments, moment generation, exponential distribution, mean of product of independent variables. 5. Covariance, the binomial and the Poisson distributions, characterisation of the Poisson distribution. 6. Exercises on the blackboard. 7. Conditional expectations. The Poisson process. 8. The normal and the Gamma distributions. 9. The central limit theorem. 10. One hour mid-term test, exercises. 11. The chi-square and the multi-normal distributions. Sampling. 12. Estimation techniques. 13. Hypothesis testing of mean. 14. Summary of the course and exercises. 15. Examination.

General_Education_Syllabus【FGL】 (2017 3rd and 4th semester classes)

Code	Subject	Evaluation Method	Textbook 1 - Textbook Title	Textbook 1 - Author	Textbook 1 - Publisher	Textbook 1 - Publication Year	Textbook 1 - ISBN/ISSN	Textbook 1 - Textbook/Reference	Textbook 2 - Textbook Title	Textbook 2 - Author	Textbook 2 - Publisher	Textbook 2 - Publication Year	Textbook 2 - ISBN/ISSN	Textbook 2 - Textbook/Reference	URL	Preparation and Review	In Addition
CB21442	Calculus C	Evaluation: By class participation and by the result of the examination.	Differential Equations and Their Applications: An introduction to applied mathematics	Martin Braun	Springer Vaerlag	1992	0387978941								https://sites.google.com/site/frankhansentohoku2016	Homework: The students are required to solve excersises for each lecture.	The lecturer prepares presentation files for each lecture and post them on the homepage for the course.
CB22401	Intermediate Japanese	Exams 60%, Quizzes 10%, Homework 10%, Attendance and class participation 20% (Details will be announced later in class)														-Preparation for quizzes. -Homework to expand vocabulary	
CB32420	Probability & Statistics	Evaluation: By class participation and by the result of the examination.	Probability and Statistics 4.ed.	Degroot and Schervish	Addison-Wesley	2012	978-0-321-70970-7								https://sites.google.com/site/frankhansentohoku2016	Homework: The students are required to solve excersises for each lecture.	The lecturer prepares presentation files for each lecture and post them on the homepage for the course.