

履修年度	講義コード	科目名/Subject	科目CD	科目名(英)	曜日・講時/Day/Period	科目群/Categories	単位数/Credit(s)	対象学部/Subject	担当教員(所属)/Instructor (Position)	セメスター/Semester	授業題目/Class Subject	授業の目的と概要/Object and Summary of Class	学習の到達目標/Goal of Study	授業内容・方法と進度予定/Contents and Progress Schedule of the Class	成績評価方法/Evaluation Method	その他/In Addition
2016	CB22307	Sport A	CA8000	Sports A	Spring, Tue./2nd	全学教育科目共通科目-保健体育	1	IMAC-U	Tetsuo ICHIGE Graduate School of Educational Science 市毛 哲夫 所属:教育学研究科	3	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"> <li>Review of basic skills needed, such as passing and receiving.</li> <li>Basic offensive techniques for setting up tossing and spiking</li> <li>Skills that lead from serving and receiving to tossing and spiking</li> <li>Skills that lead from blocking, spiking and receiving to attacking</li> <li>Practice through league-style games</li> </ul>	Attendance of the class is essential. Reports on themes not limited to volleyball, such as sport-related matters, may be required.	Students should pay close attention to the orientation and guidance on the first day of class.
2016	CB22308	Sport A	CA8000	Sports A	Spring, Tue./2nd	全学教育科目共通科目-保健体育	1	IMAC-U	Taketo KAI Graduate School of Educational Science 甲斐 健人 所属:教育学研究科	3	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.	<p>1st Guidance 2nd Practice game 3rd-7th Exercises/games 8th-15th League tournament</p> <p>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.</p> <p>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)</p>	Emphasis on practical training, attendance (80%). Group evaluations will also be given as each member's performance progresses (practical skills, understanding of strategy) (20%).	Take safety precautions, e.g. appropriate clothing, sufficient hydration, etc.
2016	CB22309	Sport A	CA8000	Sports A	Spring, Tue./2nd	全学教育科目共通科目-保健体育	1	IMAC-U	Akira TAMAGAWA School of Medicine玉川 明朗 所属:医学系研究科	3	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.	<p>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</p> <p>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.</p>	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).	
2016	CB22310	Sport A	CA8000	Sports A	Spring, Tue./2nd	全学教育科目共通科目-保健体育	1	IMAC-U	Kaori MATSUO, School of Medicine 松生 香里 所属:医学系研究科	3	Tennis	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 from lifetime sports by actually playing them, improve their abilities and communication skills, and learn life skills that will help them lead full lives as students.	<p>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.</p>	<p>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 tennis 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).</p> <p>Class 1: Guidance (selection of topics, class outline, things to be aware of), about making class notes Class 2: Physical fitness test (1) Class 3: Basic tennis techniques (ground stroke: forehand, backhand) Students will learn methods of warming up and cooling down in tennis. Class 4: Basic tennis techniques (ground stroke, rally) Building strength and mobility in tennis; training methods (1) Class 5: Tennis (ground stroke, rally, volley) Building strength and mobility in tennis; training methods (2) Class 6: Tennis (ground stroke, rally, volley, serving) Building strength and mobility in tennis; training methods (3) Class 7: Tennis (ground stroke, rally, volley, serving, receiving) Building strength and mobility in tennis; training methods (4) Class 8: Tennis (ground stroke, rally, volley, serve test) Students will learn the rules of the game, form groups, and play a short game. Class 9: Tennis (ground stroke, rally, volley, serving, receiving, game) Students will learn the rules of the game and play a short game, while communicating with other students, in competition with other groups. Class 10: Tennis (ground stroke, rally, volley, serving, receiving, game) Students will learn the rules of the game and play a short game, while communicating with other students, in competition with other groups. Class 11: Fundamentals of strength and mobility building (aerobic exercise) Class 12: Fundamentals of strength and mobility building (stretching, compensation, bodyweight training) Class 13: Fundamentals of strength and mobility building (stretching, compensation, circuit</p>	<p>Students will be evaluated with respect to attainment of goals. The goals are divided as follows: Goal 1 (Knowledge) 25 pts., Goal 2 (Technique) 25 pts., Goal 3 (Attitude) 50 pts. Methods for evaluating each goal are as follows.</p> <ul style="list-style-type: none"> <li>Goal 1: Evaluation of knowledge regarding physical training, general test</li> <li>Goal 2: Evaluation of technique during developmental mobility period (ground strokes, rally)</li> <li>Goal 3: Evaluation of attitude with respect to class learning activities</li> </ul>	<ul style="list-style-type: none"> <li>Attendance (students who ask other students answer roll call for them, leave class early, etc. will be dealt with severely)</li> <li>Attitude in class (please participate actively)</li> <li>Considerations will be made for students who have to attend official functions (e.g. tournaments for their club activities etc.)</li> <li>This class is aimed at beginners.</li> <li>Students need not bring any equipment (they may bring their own rackets if they wish).</li> <li>Students must wear appropriate clothes and shoes (they should wear shoes that will not damage the tennis court, such as tennis shoes).</li> <li>If class must be canceled due to conferences, business trips, etc., a report may be assigned by way of make-up.</li> <li>Details will be given</li> </ul>

2016	CB22311	Sport A	CA8000	Sports A	Spring, Tue./2nd	全学教育科目共通科目-保健体育	1	IMAC-U	Toshihiko FUJIMOTO Center for the Advancement of Higher Education 藤本 敏彦 所属: 高度教養教育・学生支援機構	3	Table tennis	The aim of "Sports A:Table tennis" is to gain knowledge of physical fitness, and the ability to increase physical strength, communication skills, and self-efficacy.	1)Knowledge To explain the aim and methods related to the students' own health and increase the physical strength. 2)Skill To practice exercises to increase physical strength. 3)Attitude To participate in class positively and communicate with friends.	"Sports A:Table tennis" is composed of two parts: one is table tennis, and the other is physical fitness. □ 1st Selection of sports topics and guidance 2nd Physical fitness test 3rd Physical fitness: aerobics exercise in the open air 4th Table tennis: Single match rules, topspin 5th Table tennis: Service, topspin 6th Table tennis: Push, topspin, service 7th Table tennis: Doubles rules and practice, game 8th Table tennis: Game 9th Table tennis: Game 10th Physical fitness: aerobics exercise in the open air 11th Physical fitness: aerobics exercise indoors 12th Physical fitness: Stretching, weight training 13th Physical fitness: Muscle training 14th Physical fitness test 15th Test and Summary	1)Knowledge 10%□ 2)Skill 18%□ 3)Attitude 72%	No equipment is necessary, but please prepare sportswear. We welcome beginners.
2016	CB43309	自然科学総合実験	CA3680	Introductory Science Experiments	前期 木曜日 3 講時. 前期 木曜日 4 講時	全学教育科目展開科目-理科実験	2	国際学士コース	中村 教博, 他 所属: 高度教養教育・学生支援機構 他	3	Introductory Science Experiments	This course is intended to aid students in thinking logically and to understand the fundamental concepts of natural phenomena.	The students carry out the 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 at first class. Perform one experiments in each class (in a week)□ #2 Environmental Radioactivity < Earth and Environment >□ #3 Quality of the Water in the Hirose River < Earth and Environment >□ #4 Gravity and the Earth < Earth and Environment >□ #5 Conductivity of metals, semiconductors and superconductors < Materials >□ #6 Synthesis and characterization of conductive polymers < Materials >□ #7 Synthesis of organic compounds < Materials >□ #8 Solar cells and the spectrum of the sun < Energy >□ #9 Fuel cells< Energy >□ #10 Vibrational modes of strings and music < Science and Culture >□ #11 Cells and DNA < Life >□ #12 Discrimination of the differences of animals genome DNA < Life >□ #13 Physics of biopolymers (DNA) < Life > #14 Report writing skills (Basic) #15 Report writing skills (Advance)	Attendance and report papers in each experiment	The text for the Laboratory Experiments is available at the beginning of the class. Questions about this class: please send an e-mail to t-ijikken@he.tohoku.ac.jp.
2016	CB88141	基礎ゼミ	CA5000	Introductory Seminar	前期集中 その他 連講	全学教育科目共通科目-転換・少人数科目	2	全	Frank HANSEN 所属: 高度教養教育・学生支援機構	3	Advanced calculus for functions of several variables	The course gives the participants the opportunity to expand knowledge already acquired in elementary courses in calculus. The covered material has many applications in other areas of mathematics as well as in physics, chemistry, biology and economics. The course explains in detail: □ □ 1. The notion of convexity for functions of several variables. □ 2. Local and global characterizations of convexity.□ 3. Jensen's inequality with applications. □ 4. Local extrema for functions of several variables. □ 5. Global extrema for functions of several variables defined on a compact set.	The student will obtain the ability to analyze concrete functions of several variables, to search and find local and global extrema, to establish convexity or concavity of concrete functions, and to derive non-trivial inequalities by applying Jensen's inequality to concrete functions.	The course is planned to cover three Saturdays of activities in June 2016 although the details may be negotiated. Intensive lectures are interrupted by a number of sessions, where we solve exercises. The students are expected to do homework between the lectures and to write a final report. The teacher will provide written material covering the course and handout a number of exercises to be solved by the participants.	Evaluation by the quality of the written report, by the level of active class participation, and by the ability to solve selected problems.	The orientation class will be held on April 18th(Mon.), 2016 at 4:50 pm.
2016	CB88142	基礎ゼミ	CA5000	Introductory Seminar	前期集中 その他 連講	全学教育科目共通科目-転換・少人数科目	2	全	Nurbosyn ZHANPEISOV 所属: 高度教養教育・学生支援機構	3	Fundamental Chemistry Seminar on Selected Topics	The chemistry seminar will further deepen the lecture notes on the structure and properties of atoms and molecules, thermodynamic state equations, chemical equilibrium and reaction kinetics.	One must be able to solve different chemical problems and tasks dealing with the chemical kinetics, thermodynamics and atomic (molecular) structures. Also one must understand fundamental relationships and units to describe tiny chemical and physical properties of any chemical associations.	第 1 回 Introduction□ 第 2 回 Atomic Structure□ 第 3 回 Electronic Configuration□ 第 4 回 Hückel theory □ 第 5 回 Kinetic theory of gases□ 第 6 回 Chemical reaction kinetics□ 第 7 回 Variety of reaction types and reaction rates□ 第 8 回 Examples and applications□ 第 9 回 Mid-term test□ 第 1 0 回 Thermodynamics□ 第 1 1 回 First, second and third laws of thermodynamics□ 第 1 2 回 Calculation of entropy changes□ 第 1 3 回 Thermodynamic state equations□ 第 1 4 回 Concluding remark□ 第 1 5 回 Final-test	Evaluation will be based on class attendance, reports and on the results of mid-term and final-tests.	The orientation class will be held on April 18th(Mon.), 2016 at 4:50 pm. □ The seminar attendance will be strictly controlled.

2016	CB88143	基礎ゼミ	CA5000	Introductory Seminar	前期集中 その他 連講	全学教育科目共通科目-転換・少人数科目	2	全	Igor TRUSHIN 所属：高度 教養教育・学生支援機構	3	Fundamental mathematics seminar on selected topics of calculus	The mathematics seminar will further deepen the knowledge of the basic properties of derivative and integral	One should be able to solve different problems, using basic techniques and theorems of calculus.	Contents and progress schedule of the class: □ -Real numbers, limits, functions □ -Derivatives, the mean value theorem and its applications□ -Integrals, applications of integration	Evaluation will be based on class attendance and reports	The orientation class will be held on April 18th(Mon.), 2016 at 4:50 pm.
2016	CB88144	基礎ゼミ	CA5000	Introductory Seminar	前期集中 その他 連講	全学教育科目共通科目-転換・少人数科目	2	全	Martin ROBERT, Gaku KUMANO, Ayaki Nakamoto 所属：高度教養教育・学生支 援機構、生命科学研究所、生 命科学研究科	3	Interactive Short Course in Marine Biology	Summary: A 5-day intensive, camp-like scientific experience to be held at the Research Center for Marine Biology of Tohoku University in Asamushi (Aomor- ken).□ □ This course is based on small group activities that will be meant to include and favor interaction between international and Japanese students. Activities will be performed in English and will aim at improving communication and discussion between group members. Another major objective is to learn the basics of the scientific method by performing simple ecology and cell biology experiments with marine organisms in small groups. To learn through practice principles of marine animal behavior and witness the amazing process of marine invertebrate fertilization and early development, in a beautiful natural setting. The students will learn the basics and experience first-hand through field activities on the shore of Aomori bay and in the adjacent laboratories of the Asamushi Research Center.	To learn the basics of the scientific method by performing simple ecology and cell biology experiments with marine organisms in small teams.□ □ Based on their own ideas, students will design and perform simple experiments to test hypotheses. By trial and error, students can discover on their own basic principles of the scientific process and method. One objective will also be able to explain to other group members one's ideas effectively.	After receiving a brief explanations and guidance, students will collect marine samples, plan and develop experiments with marine organisms and perform various experiments in small groups. Discussion of results and their interpretation is an important activity. On the last day, students will present their results in a short oral presentation and prepare a short report, to be done in English.□ □ Tentative plan (to be confirmed)□ □ Day 1 (August 28)□ 10:30 Departure: from Sendai station to Aomori station (15:20) (highway bus)□ 15:54 Aomori Train to Asamushi station (16:09)□ 16:30 Arrival at RCMB, Asamushi. Check in. 17:30-18:30□ Orientation and course introduction□ □ Day 2 (August 29)□ Full program day (field and laboratory work)□ Sea shell extrusion behavioral experiments□ □ Day 3 (August 30)□ Full program day (field and laboratory work)□ Off-shore plankton collection□ Fertilization and early development of the sea urchin□ □ Day 4 (August 31)□ Full program day (field and laboratory work).□ Exploring the unique walking behavior of sea roaches□ □ Day 5 (September 1st)□ 9:00-12:00 Program wrap up, student presentations and discussions, report submission□ 13:30 Checkout□ 14:04 Aomori Train to Aomori station (14:27)□ 14:40 Return: from Aomori station to Sendai station (19:30) (highway bus)	Attendance and active participation□ Oral presentation (50%) and report (50%)	The orientation class will be held on April 18th(Mon.), 2016 at 4:50 pm. □ Basic high school level biology is recommended and availability to stay for the duration of the whole program is important.The course is planned from Sunday August 28 until Thursday September 1st, inclusively. You must be able to stay at the Marine Biology Center in Asamushi for 4 nights, 5 days in total.□ □ We are pleased to welcome Japanese and International students from any background, including Liberal Arts and Humanities. We welcome any student interested in an international interactions and a scientific experience on the sea shore of Aomori prefecture.
2016	CB42327	物理学B	CA3220	Physics B	前期 木曜日 2 講時	全学教育科目展開科目-物理学	2	国際学士コース	カーロウ綿村ウルスラ 所 属：	3	Oscillations, waves, propagation of waves in media, stress and strain, fluid dynamics	Object and summary of class: Study of oscillation phenomena; study the propagation of waves and related physical phenomena. Properties of materials (different from the idealized rigid bodies) and their response to forces.	Goal of study: To understand the nature of oscillation phenomena which includes the simple motion of pedulum, propagation of waves and their properties. In particular we will treat sound waves, Doppler effect and shock waves. In this subject we also learn how to analyze such type of problems using differential equations. Finally, properties of materials (different from the idealized rigid bodies) are introduced and their response to forces is treated.	Schedule of class:□ □ 1. periodic motion; simple harmonic motion; angular simple harmonic motion□ 2. energy in simple harmonic motion; simple pendulum;□ 3. damped vibrations; practice□ 4. forced oscillations and resonance□ 5. waves and their properties; wave functions; wave dynamics; wave power□ 6. standing wave on a string; superposition of waves□ 7. midterm test□ 8. sound waves; intensity and sound intensity level; standing sound waves□ 9. interference effects: beats; practice□ 10. Doppler effect; shock waves; practice□ 11. stress, strain; elasticity; different types of stress Hooke's law□ 12. density and pressure; pressure in a fluid at rest; buoyancy□ 13. fluid flow, Bernoulli's equation; viscosity and turbulence □ 14. summary of the course; practice□ 15. final exam	Evaluation based on: midterm test (40%), final exam (45%), homework problems (10%), class attendance (5%)	The reference mentioned above is meant as a guideline.□ Some more references relating to the subject will be announced in the lecture.□ contact: ursula@tuhep.phys.tohok u.ac.jp
2016	CB22305	生命科学B	CA3420	Biology B	前期 火曜日 2 講時	全学教育科目展開科目-生物学	2	国際学士コース	ROBERT MARTIN 所属：高 度教養教育・学生支援機構	3	Essential Biochemistry	Biochemistry is a vast field that covers the basic structure, function, and transformation of the biomolecules that characterize living systems. The objective of this course is for the student to acquire a fundamental understanding about biomolecules, proteins, enzymes and catalysis as well as 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 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 metabolic function in living systems□ - Appreciate the larger picture view and important connectivity among all these biomolecules and pathways.□ □ To achieve this, students will complete weekly reading and exercise assignments for the units listed below. Quizzes, in-class group activities and exercises will promote interactions and student learning. In addition to those activities, a mid-term and final exam will be used to evaluate student	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.□ 9) Membrane structure (lipid bilayer and membrane proteins)□ 10) Basic metabolism overview: principles of cellular energy conversion□ 11) Glycolysis, gluconeogenesis, and the pentose phosphate pathway□ 12) The tricarboxylic acid (TCA) cycle and the glyoxylate pathway□ 13) Cellular respiration and fermentation pathways□ 14) The electron transport chain and oxidative phosphorylation□ 15) Photosynthesis □ 16) Analysis of biomolecules and metabolic function. Proteomics and metabolomics□ 17) Final examination	Attendance and active participation (20%), weekly exercises and assignments (30%), examinations (50%).	1) This is a general, entry-level course open to all students and is compulsory for FGL-AMB program. Together with Biology A (Essential Cell Biology), this course presents a basic introduction to biochemistry and molecular cell biology. Some familiarity with basic organic chemistry and biology is assumed. Japanese and exchange students are encouraged to take this course, knowing that this is an introductory course that is held in English.□ 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. □ 3) Instructor available for questions and consultation during office

2016	CB31320	物理学 C	CA3230	Physics C	前期 水曜日 1 講時	全学教育科目展開科目-物理学	2	国際学士コース	カーロウ綿村ウルスラ 所属:	3	Electromagnetism	Study of electric and magnetic interaction with a brief introduction of the unified picture of electromagnetism	Understanding the principles of electromagnetism and its application	Schedule of class: 1. Introduction: Overview of the subject, mathematical techniques, vector fields and potentials 2. Electrostatics: electric field, Coulomb's law, continuous charge distributions, electric dipoles 3. Divergence and curl of electrostatic fields, flux, Gauss's law, electric potential, Poisson equation 4. Electric fields in matter: Capacitance, energy storage in Capacitors, dielectrics, induced charges, Gauss's law in dielectrics 5. Current, resistance and electromotive force, energy and power in electric circuits 6. Summary; practice 7. Midterm test 8. Magnetostatics: Lorence force, Biot-Savart law, divergence and curl of magnetic field, Hall effect 9. Magnetic vector potential, magnetic field in matter 10. Magnetic field of a moving charge, Ampere's law 11. Electrodynamics: Ohm's law, electromotive force 12. Electromagnetic induction: Faraday's law, Lenz's law 13. Maxwell equations and electromagnetic waves 14. Summary of the lecture; practice 15. Final exam	Evaluation base on: midterm test (40%), final exam (45%), homework problems (10%), class participation (5%)	The reference given above is meant as a guideline. For questions mail to: ursula@tuhep.phys.tohoku.ac.jp
2016	CB33307	化学 C	CA3330	Chemistry C	前期 水曜日 3 講時	全学教育科目展開科目-化学	2	国際学士コース	ZHANPEISOV, Nurbosyn 所属: 高度教養教育・学生支援機構	3	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.	第1回Hybridization of carbon and types of chemical bonds in organic compounds 第2回Electronic effects of substituent, intermediates, bond break 第3回Acids and bases (Bronsted, Lewis, Conjugate), effect of substituent 第4回Saturated hydrocarbon (alkane): natural resources and chemical properties 第5回Unsaturated hydrocarbon (alkene): the nature of double bond and isomerism 第6回Unsaturated hydrocarbon (alkyne): C-H group acidity 第7回Dienes: Stereochemistry and its application in organic synthesis 第8回Mid-term test 第9回Nucleophilic substitution at saturated carbon atom 第10回Alcohols and ethers 第11回Aromatics: five- and six-membered organic substances 第12回Aromaticity and anti-aromaticity 第13回Aldehydes and ketones: industrial production of HCOH and CH3COH 第14回Carboxylic acids: physical and chemical properties 第15回Term-end test	Evaluation will be based on class attendance, reports and on the results of a term-end test.	The lecture attendance will be strictly controlled.
2016	CB34310	生命科学 C	CA3430	Biology C	前期 水曜日 4 講時	全学教育科目展開科目-生物学	2	国際学士コース	ROBERT MARTIN 所属: 高度教養教育・学生支援機構	3	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 toward a better	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: - Understand some of the essential principles of systems theory and organization as well as principles of engineering that are applicable in biology - 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 basic network structures, interactions, and their dynamics - Appreciate the power of modeling to study complex biological systems To achieve these objectives, students will complete weekly reading and exercise assignments for the units listed below. Quizzes, in-class group activities and exercises will promote interactions and student learning. In addition, a mid-term and final exam as well as a team project 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	Attendance and active participation (10%), exercises and assignments (30%), mid-term and final examinations (40%), project (20%).	1) This is a general, entry level course with no prerequisite although it assumes some basic biology and high-school level mathematical skills. The course is open to all students and is compulsory for first-year FGL-AMB program students. Japanese and exchange students from biology majors or from other fields of science and engineering are encouraged to take this course, knowing that this is an introductory course that is held 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).
2016	CB24310	解析学 B	CA3050	Calculus B	前期 火曜日 4 講時	全学教育科目展開科目-数学	2	国際学士コース	TRUSHIN IGOR 所属: 高度教養教育・学生支援機構	3	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	Evaluation will be based on results of a tests and home work	

2016	CB35305	歴史学	CA2050	History	前期 水曜日 5 講時	全学教育科目展開科目-人文科学	2	国際学士コース	芳賀 満 所属：高度教養教育・学生支援機構	3	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)	Evaluation will be based on attendance and performance in the classroom (30%) and final report (70%).	
2016	CB21320	言語学	CA2060	Linguistics	前期 火曜日 1 講時	全学教育科目展開科目-人文科学	2	国際学士コース	吉本 啓 所属：高度教養教育・学生支援機構	3	Introduction to Linguistics	The purpose of the course is to let participants understand the way humans communicate their thoughts with language through various levels of information processing. It will help them understand more about the humans and themselves.	At the end of the semester, students will □ -have basic knowledge about human linguistic faculty.□ -have a new perspective on linguistic communities different from their own.	1st Week: Introduction to the study of language □ 2nd & 3rd Weeks: Phonetics, the study of speech sounds □ 4th & 5th Weeks: Morphology, the study of how words are formed □ 6th & 7th Weeks: Syntax, the study of how sentences are structured □ 8th & 9th Weeks: Semantics, the study of meaning □ 10th & 11th Weeks: Neurolinguistics, the study of how the brain processes language □ 12th Week and thereafter: Application of the learned methods and exercises	Exams 60%, homework 20%, attendance and class participation 20%	Textbook and references will be notified at the class.
2016	CB21413	解析学 C	CA3060	Calculus C	後期 火曜日 1 講時	全学教育科目展開科目-数学	2	国際学士コース	HANSEN FRANK 所属：高度教養教育・学生支援機構	4	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.	第1回 Ordinary differential equations and the first order ODE. □ 第2回 Existence and uniqueness of solutions. □ 第3回 Linear differential equations. □ 第4回 Bernoulli's ODE, the second order ODE. □ 第5回 Second order linear differential equation. The guessing method. □ 第6回 Exercises on the blackboard. □ 第7回 Systems of linear differential equations. □ 第8回 Matrix exponentials, higher order linear differential equations. □ 第9回 Solving ODEs by power series. □ 第10回 One hour mid-term test, exercises. □ 第11回 Legendre's differential equation. □ 第12回 The Laplace transform and the solution of linear ODEs. □ 第13回 Newton's equation, Hamiltonian mechanics and the mathematical pendulum. □ 第14回 Summary of the course and exercises. □ 第15回 Examination.	Evaluation: By class participation and by the result of the examination.	The lecturer prepares presentation files for each lecture and post them on the homepage for the course.
2016	CB52301	線形代数学 B	CA3100	Linear Algebra B	前期 金曜日 2 講時	全学教育科目展開科目-数学	2	国際学士コース	TRUSHIN IGOR 所属：高度教養教育・学生支援機構	3	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	Evaluation will be based on results of a tests and home work	
2016	CB25301	Basic Japanese 2	CA9310	Basic Japanese 2	前期 火曜日 5 講時, 前期 水曜日 2 講時, 前期 木曜日 5 講時	全学教育科目共通科目-留学生対象科目	3	国際学士コース	菅谷 奈津恵, 吉本 啓 所属：高度教養教育・学生支援機構	3	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	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%	

2016	CB32404	数理統計学	CA3110	Probability & Statistics	後期 水曜日 2 講時	全学教育科目展開科目-数学	2	国際学士コース	HANSEN FRANK 所属：高度教養教育・学生支援機構	4	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.	第1回 State and sample space, events, probability, independence. □ 第2回 Measure and probability, stochastic variables and independence. □ 第3回 Distributions, stochastic vectors and independence, expectation for discrete and continuous variables. □ 第4回 Variance, higher moments, moment generation, exponential distribution, mean of product of independent variables. □ 第5回 Covariance, the binomial and the Poisson distributions, characterisation of the Poisson distribution. □ 第6回 Exercises on the blackboard. □ 第7回 Conditional expectations. The Poisson process. □ 第8回 The normal and the Gamma distributions. □ 第9回 The central limit theorem. □ 第10回 One hour mid-term test, exercises. □ 第11回 The chi-square and the multi-normal distributions. Sampling. □ 第12回 Estimation techniques. □ 第13回 Hypothesis testing of mean. □ 第14回 Summary of the course and exercises. □ 第15回 Exmination.	Evaluation: By class participation and by the result of the examination.	The lecturer prepares presentation files for each lecture and post them on the homepage for the course.
2016	CB22402	Intermediate Japanese	CA9320	Intermediate Japanese	後期 火曜日 2 講時 後期 火曜日 3 講時 後期 水曜日 1 講時	全学教育科目共通科目-留学生対象科目	3	国際学士コース	内山 敦子, 安住 ゆかり 所属：	4	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 phase」 □ 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	Exams 60%, Quizzes 10%, Homework 10%, Attendance and class participation 20% □ (Details will be announced later in class)	