

<1> Physics A

Class Schedule: Monday, 2nd. (2 credits)

Category: Basics of Discipline-Basics of Physics

Course Code: CB12202

Instructors: Takeshi KOIKE

1. Class Subject

Classical Mechanics

2. Object and Summary of Class

This is an introductory course to Newtonian mechanics, but also serves as an introduction to the way we try to understand various natural phenomena encountered in Physics B (oscillations and waves, fluid dynamics) and Physics C (electromagnetism). Mechanics deals with motion of a physical body as well as response to forces applied to the body. The mechanics we study in this course is applicable to an object or system of particles that is slow moving in comparison to the speed of light (non relativistic) and large enough in physical scale as to be unaffected by quantum fluctuations, hence the name "classical".

3. Goal of Study

By the end of the course, you are expected to gain familiarity with and obtain basic understandings of Newton's laws, work and energy, conservation of energy, linear momentum, and angular momentum, systems of particles, rotations, and Newton's law of gravitation with Kepler's law of planetary motions.

4. Contents and Progress Schedule

Schedule of the course:

0. Orientation to WileyPlus + historical perspective of Newtonian mechanics
1. Ch3: Vectors (General introduction to physics, scalar vs vector, addition, dot and cross product, unit vector, and vector and calculus)
2. Ch4: Motion in Two and Three Dimensions (Projectile motion under uniform gravity, uniform circular motion, and relative motion)
3. Ch5: Force and Motion I (Newton's law of motion, its applicability, Galilean relativity, inertial frame, force and rate of change of linear momentum, and conservation of momentum)
4. Ch6: Force and Motion II (free body diagram, frictional force, drag force (viscous and inertial), and centripetal force)
5. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)
6. Ch8: Potential Energy (isolated system, conservation of energy, conservative force and potential energy)
7. Ch9: Center of Mass (a system of particles, center of mass, conservation of total momentum of a system, and reduced mass of two body system)
Midterm (Lecture 2-6)
8. Ch9: Collision (impulse, elastic and inelastic collision, and rocket equation)

9. Ch10: Rotation (correspondence between linear and angular motion, moment of inertia, parallel and orthogonal axis theorem, center of mass and gravity)

10. Ch11: Rolling, Torque, and Angular Momentum (rigid body, torque as a rate of change of angular momentum, torque in the center of mass frame, rolling on an inclined plane)]

11. Ch11 (rolling on a flat surface, physics of tops, precession, and gyroscopic effect)

12. Ch13: Gravitation (central force, effective potential, constant of motion, Kepler's law of planetary motion)

13. Ch13: Gravitation (gravity near the earth surface, gravitational potential) and Course survey

Final examination (Lecture 7-13)

5. Evaluation Method

Evaluation will be based on a midterm exam (30%), final exam (30%), homework assignments (20%), pre-lecture assignment(20%).

6. Textbook and References

Fundamentals of Physics Extended, 11th Edition David Halliday, Robert Resnick, Jearl Walker Wiley 2018 textbook
The Feynman Lectures on Physics, Volume I Feynman • Leighton • Sands Feynman • Leighton • Sands

7. URL <https://www.wileyplus.com/>

8. Preparation and Review

A pre-lecture reading of the textbook followed by short adaptive quizzes will be assigned for each lecture. In addition, after each lecture, a set of selected problems from WileyPlus will be assigned.

9. Students must bring their own computers to class Yes.

Various demonstration/simulation with Python and MATLAB will be performed.

10. In Addition

This course requires purchase of the WileyPlus system which costs \$40 USD. The system includes an electronic version of the required textbook with many integrated features to facilitate understanding of the subjects and problem solving skills in physics. The system also comes with self-diagnostic adaptive quizzes, with which one will practice problem solving based on his/her own proficiency in each chapter that will be covered in the course. Access to the internet is necessary outside of the class. Registration to the WileyPlus and payment method will be announced in the orientation during the first lecture.

<2> Life and Nature

Class Schedule: Tuesday, 2nd. (2 credits) Category: Foundations-Life

Course Code: CB22231 Instructors: Satoshi KATAYAMA

1. Class Subject

Life and Nature: Dynamics of the Earth-The evolution of the universe, the earth, and life

2. Object and Summary of Class

This course aims to provide an overview of the natural processes that occurred over 13.7 billion years. Many classes would be taught by instructors from School of Science. An important ambition is to help students in various fields appreciate the importance, interdependence and connections between physical, chemical, biological, and social sciences. The course will provide a broad perspective about the fantastic growth in complexity in the universe and on the earth throughout their history.

Students will explore the origin of our universe, of stars and our own solar system, and our home planet. This will be followed by dynamics of the earth, an overview of the origin of life on the earth and the intricate connectivity between living organisms and our planet, leading to massive diversification and evolution. This course will motivate the students to think about the larger issues and challenges in science and technology. The course will also highlight our current knowledge based on scientific evidence, introduce how scientific ideas evolve and address some of the remaining big and unsolved questions.

3. Goal of Study

In this course, the student will gain a broad perspective about natural and living systems, their basic constituents and properties. The student will also better understand how natural and living systems consist of complex networks of elements whose intricate and dynamical balance is critical for our planet and all its inhabitants, the ultimate global ecosystem.

4. Contents and Progress Schedule

TBA

5. Evaluation Method

TBA

6. Textbook and References

7. URL

8. Preparation and Review

TBA

9. Practical business

10. Students must bring their own computers to class TBA

11. In Addition

<3> Linear Algebra A

Class Schedule: Tuesday, 3rd. (2 credits) Category: Basics of Discipline-Basics of Mathematics

Course Code: CB23230 Instructors: Marcin SCHROEDER

1. Class Subject

Linear Algebra A

2. Object and Summary of Class

This is the first of the two courses in Linear Algebra. Students are learning the broad range of concepts such as vector spaces over the fields of real and complex numbers, linear independence and bases of vector spaces, solving systems of linear equations, linear mappings, matrices and matrix representation of linear mappings, similarity of matrices, determinants of matrices, transformations of bases and corresponding transformations of matrix representations, diagonalization and spectral theorem.

3. Goal of Study

The main goal is to develop in students the understanding of the conceptual framework of linear algebra and the skills in the application of these concepts for solving problems both within this domain as well as in its applications in analytic geometry, calculus, differential equations and in physics.

4. Contents and Progress Schedule

Class 1: The fields of real and complex numbers.

Class 2: Vector spaces, linear independence, bases

Class 3: Matrices over real and complex numbers

Class 4: Solving systems of linear equations with multiple unknowns

Class 5: Linear mappings

Class 6: Kernel and Image of linear mappings, linear isomorphisms

Class 7: Linear mappings and their matrix representation, change of bases

Class 8: Scalar products, inner product spaces

Class 9: Orthogonality and orthonormalization of bases

Class 10: Determinants and their applications

Class 11: Inverse of matrix, rank of matrix

Class 12: Symmetric, orthogonal, Hermitian and Unitary operators

Class 13: Eigenvectors and eigenvalues

Class 14: Diagonalization of symmetric and self-adjoint operators

Class 15: Final examination

5. Evaluation Method

The course grade is based on:

the credit in the weekly homework assignments 50%
and the final examination 50%.

6. Textbook and References

Linear Algebra 3rd ed. Serge Lang Springer 2004

7. URL -

8. Preparation and Review

Students receive homework assignments (ca. 10 problems) after each class. They have to submit solutions before the next class. All classes are face-to-face (whenever not precluded by BCP rules). The additional communication with students is through the Google Classroom platform or email whenever they have questions..

9. Practical business

10. Students must bring their own computers to class No need for bringing laptops to class, but students may use them if they wish..

11. In Addition

Only students who received at least 50% credit in homework will be admitted to the final exam.

<4> Physics A

Class Schedule: Friday, 1st. (2 credits) Category: Basics of Discipline-Basics of Physics

Course Code: CB23231 Instructors: Takeshi KOIKE

1. Class Subject

Introductory Physics

2. Object and Summary of Class

This course is intended for students without any or little background in physics and calculus. Through Newtonian mechanics, important concepts in physics such as force, momentum, energy, angular momentum, and laws of conservation will be introduced. In addition, how these concepts are described in the language of mathematical equations, in particular, using calculus will be explored.

3. Goal of Study

By the end of the course, you are expected to gain familiarity with Newton's laws of motion, momentum, and energy, and angular momentum as well as their conservation properties. In addition, you are expected to be able to draw a free-body diagram, derive an equation of motion, and solve it using simple vector algebra and calculus.

4. Contents and Progress Schedule

Schedule of the course:

0. Orientation to WileyPlus and a historical perspective of Newtonian mechanics

1. Ch1: Measurement (unit)

2. Ch2: Motion Along a straight line (acceleration and free fall)

3. Ch3: Vectors

4. Ch4: Motion in Two and Three Dimensions (Projectile motion under uniform gravity)

5. Ch4: Motion in Two and Three Dimensions (Uniform circular motion, and relative motion)

6. Ch5: Force and Motion I(Newton's law of motion)

7. Ch5 and Ch6: Force and Motion I & II (free body diagram, frictional force, and centripetal force)

Midterm examination (Ch1-Ch6)

8. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)

9. Ch7: Kinetic Energy (transformation and transfer of energy, work, work done by gravity, work done by spring, and power)

10. Ch8: Potential Energy (isolated system, conservation of energy, conservative force and potential energy)

11. Ch9: Center of Mass (a system of particles, center of mass, conservation of total momentum of a system)

12. Ch10: Rotation (coresspondence between linear and angular motion, moment of inertia, angular momentum)

13. Review and course survey

Final examination (Lecture 7-10)

5. Evaluation Method

Evaluation will be based on a midterm exam (25%), final exam (25%), homework assignments (20%), attendance (10 %), pre-lecture assignment (20%).

6. Textbook and References

Fundamentals of Physics Extended, 11th Edition David Halliday, Robert Resnick, Jearl Walker Wiley 2018 textbook

7. URL

<https://www.wileyplus.com/>

8. Preparation and Review

A pre-lecture reading of the textbook followed by short adaptive quizzes will be assigned for each lecture. In addition, after each lecture, a set of selected problems from WileyPlus will be assigned.

9. Practical business

10. Students must bring their own computers to class Yes.

Various demonstration/simulation with Python and MATLAB will be performed.

11. In Addition

If you are planning to take Physics B or/and C, you must register for another Physics A, which is targeted for chemistry and engineering majors with highschool-level physics and calculus background. This course requires purchase of the WileyPlus system which costs \$40 USD. The system includes an electronic version of the required textbook with many integrated features to facilitate understanding of the subjects and problem solving skills in physics. The system also comes with self-diagnostic adaptive quizzes, with which one will practice problem solving based on his/her own proficiency in each chapter that will be covered in the course. Access to internet is necessary outside of the class. Registration to the WileyPlus and payment method will be announced in the orientation during the first lecture.

<5> Economy and Society

Class Schedule: Wednesday, 1st. (2 credits) Category: Foundations-Social Sciences

Course Code: CB31223 Instructors: Jeremy Ryan September

1. Class Subject

Social Entrepreneurship: An Introduction

2. Object and Summary of Class

In this course students will receive a comprehensive overview of the field of social entrepreneurship. The course will combine theoretical knowledge and practical examples of social entrepreneurship. Students with a more practical interest will be encouraged to develop their own ideas and plans regarding potential social entrepreneurship projects. Thus, this course is designed for students who want to explore social enterprise start-ups, as well as those students who are just curious about the field and want to learn more about entrepreneurship.

This course also explores the role of Social Entrepreneurship as a lever for economic, social and sustainable development. The subject of Social Entrepreneurship overlaps with a number of fields including the nonprofit sphere, development projects, SMEs, community initiatives and others. This multiplicity will be reflected in the course contents.

3. Goal of Study

The study goals for this course are as follows:

- 1) For students to acquire foundational knowledge of social entrepreneurship theory.
- 2) For students to acquire a broad understanding of the operation of a social enterprise
- 3) For students to deepen their understanding by exploring their particular interests within this field through class discussion and assignments.

4. Contents and Progress Schedule

Lesson 1: Background, Characteristics and Context of Social Entrepreneurship

Focus: Introduction to the course.

The evolution and historical background of social entrepreneurship.

Lesson 2: Social Entrepreneurship Defined

Focus: Define the central elements of social innovation.

Identify the different types of social innovation.

Lesson 3: Value Creation in social ventures

Focus: Define what the creation of value is.

Analyze the value proposition by social innovation

Lesson 4: Social Entrepreneurs and their Personality

Focus: Understand the role of personality in entrepreneurship studies.

Describe the current knowledge on the personality in social entrepreneurs.

Lesson 5: Human Resource Management and Volunteer Motivation

Focus: Understand the special characteristics of volunteers.

Illustrate the theoretical elements in a practical context.

Lesson 6: Collaborations and Partnerships

Focus: Explain the reasoning behind social venture partnerships

Discuss the collaborative value chain integration and specific types of collaboration.

Lesson 7: Business Models in Social Entrepreneurship

Focus: Explain what a business model is. Explain the differences between business models of commercial enterprises and business models of social enterprises.

Lesson 8: Marketing a Social Enterprise

Focus: Generate an awareness of the characteristics of marketing in social enterprises. Understand a systematic approach to marketing in terms of a concerted marketing conception.

Lesson 9: Financing of Social Entrepreneurship

Focus: Describe the characteristics of the financing structure of social enterprises. Explain the financing instruments available for social enterprises. Explain the trade-off between social and financial return.

Lesson 10: Performance Measurement and Social Entrepreneurship

Focus: Understand the origins of the current momentum in measuring social impact. Critically evaluate efforts to measure social impact

Lesson 11-12: Student Presentations: The first/second round of students' group presentations

Lesson 13: New Technologies and perspectives

Focus: An explanation of the most disruptive technologies being developed and their potential influence on social entrepreneurship

Lesson 14: Innovative Case Study

Focus: A description of a The Grassroots Economics Foundation in Kenya and their innovative work.

Lesson 15: Course Reflection - Students also have group discussions regarding their reflections of the course.

5. Evaluation Method

Minute Paper and Contributions for the development of the Class: 50%

Group Presentations 20%, Final Essay 30%

6. Textbook and References

Social Entrepreneurship and Social Business Christine K. VolkmannKim Oliver TokarskiKati Ernst SpringerLink 2012 e-book

Social Innovation and Social Entrepreneurship Luis Portales Palgrave Macmillan 2019

7. Preparation and Review

The students will be provided with material and readings for each lecture. They will be expected to read in advance so as to contribute towards class discussion.

8. Students must bring their own computers to class

As this course will be an online course, students will need access to a computer.

<6> Chemistry A

Class Schedule: Wednesday, 2nd. (2 credits)

Category: Basics of Discipline-Basics of Chemistry

Course Code: CB32224 Instructors: Mott Derrick

1. Class Subject

Introduction to Chemistry, Atoms and Molecules

2. Object and Summary of Class

Chemistry includes the fundamental analysis of atoms and molecules, which make up the world around us. By understanding the basics of atomic structure, reactivity and the formation of molecules, it is possible to create new substances with uses in advanced applications including medicine, energy, materials, environmental quality and others. The goal of this class will be to become familiar with the basics of chemistry, understand what atoms are composed of and their structure, learn about compounds, how to study these materials, and how they may be used to improve quality of human life.

3. Goal of Study

Gain an understanding of fundamental chemistry, what are atoms, understand their composition and structure.

Learn about electronic structure of atoms, how it influences chemical reactions and material formation.

Become familiar with different types of chemical bonds (ionic bonds, covalent bonds, coordination bonds, and metallic bonds).

4. Contents and Progress Schedule

1st: Introduction to chemistry, atomic and electronic structure of simple atoms, fundamental characteristics of atoms

2nd: Atomic and electronic structure of higher atomic number elements

3rd: Periodic properties of elements: Spin quantum number, Pauli exclusion principle

4th: Periodic properties of elements: Effective nuclear charge, electron orbital arrangement

5th: Periodic properties of elements: Ionization energy and electron affinity, electronegativity

6th: Quiz 1, Ionic and metallic bonds

7th: Covalent bonding (1): Octet rule

8th: Covalent bonding (2): Molecular orbital method (σ bond, π bond, etc.)

9th: Covalent bonding (3): Bonding nature of molecular orbitals and bond order

10th: Covalent bonding (4): Molecular shape, hybrid orbitals and conjugate systems

11th: Quiz 2, Intermolecular force, hydrogen bonds

12th: Analyzing materials: Spectroscopy techniques

13th: Crystalline solids, amorphous materials, metallic glasses

14th: Technological advancement and chemistry: Applications of chemistry in daily life

15th: Introduction to chemistry disciplines, review, final examination

5. Evaluation Method

Evaluation is based on quizzes (20%), course participation (20%), homework assignments (20%), final examination (20%), and class attendance (20%).

6. Textbook and References

Fundamentals of Physics Halliday and Resnick Wiley Plus 2018
Wiley Plus

7. URL

8. Preparation and Review

Read the designated textbook sections to prepare for each class.

9. Practical business

10. Students must bring their own computers to class Yes

11. In Addition

<7> Information and Data Literacy

Class Schedule: Thursday, 1st. (2 credits) Category: Advanced Subjects-Information Science and Technology Education
Course Code: CB41216 Instructors: Xavier DAHAN

1. Class Subject

Information and data literacy

2. Object and Summary of Class

(1) Acquire social skills to make appropriate decisions and actions, taking responsibilities and being aware of ethics as citizens living in today's information society.

(2) Understand the significance of learning problem-solving methods and data

science, utilizing computers, become able to make human-centered understandings and decisions in regard to the large-scale data technologies, and to find issues in the real-world problems concerning those technologies

3. Goal of Study

- Acquire appropriate knowledge on information technologies, such as the cyber security, to take appropriate action and decision in the information society.
- Become able to resolve problems through the computer science skills.
- Become able to handle large-scale data and basic statistic, and to make appropriate human-centered understanding and decision in regard to the data-science-related technologies in today's data-driven society.

4. Contents and Progress Schedule

1. Orientation

Guidance on the topics of the class and preparation on the computers

2. Basics on Information Systems

Basic knowledge on several representative information services, such as the use identification and the email, and basic instructions.

3. Social Skill (1)

Cyber security: security and risk on the information technology

4. Social Skill (2)

Laws and regulations on the information technology and intellectual property rights

5. Science Skill I (Problem-solving through computer science (1))

Computational thinking: Logical thinking and problem solving through computer science

6. Science Skill I (Problem-solving through computer science (2))

Python programming for beginners: variables, input-and-output

7. Science Skill I (Problem-solving through computer science (3))

Python programming for beginners: loops and branches

8. Science Skill I (Problem-solving through computer science (4))

Python programming for beginners: a few representative data structures

9. Science Skill I (Problem-solving through computer science (5))

Python programming for beginners: functions and recursions

10. Science Skill I (Problem-solving through computer science (6))

Python programming for beginners: exercise on problem-solving by Python

11. Science Skill II (Basics on Data Science (1))

Practical examples of large-scale data and AI in the today's data-driven society

12. Science Skill II (Basics on Data Science (2))

Statistics through Python (1): Basic values on statistics

13. Science Skill II (Basics on Data Science (3))

Statistics through Python (2): Practical training on statistics using real-world data

14. Science Skill II (Basics on Data Science (4))

Statistics through Python (3): Practical training on statistics using real-world data

15. Science Skill II (Basics on Data Science (5))

Ethics on data science and technology, and related issues on the real-world

5. Evaluation Method

Evaluation will be made by the two-or-three term assignments. The attendance will be taken into consideration up to 20%.

6. Textbook and References

コンピュータショナル・シンキング 磯辺秀司, 小泉英介, 静谷啓樹, 早川美徳 共立出版 2016
情報倫理ケーススタディ 静谷啓樹 サイエンス社 2008

7. URL

Information on the class can be found in <https://olg.cds.tohoku.ac.jp/jkisoforstudent>.

8. Preparation and Review

- Students are expected to engage themselves in works and exercises given in the class, and to submit papers.
- Students can make use of various supplementary materials on the cyber security, python programming, data science and AI for the self-study purpose. Instructions will be given in the lectures.

<8> Biology A

Class Schedule: Thursday, 4th. (2 credits) Category: Basics of Discipline-Basics of Biology

Course Code: CB44207 Instructors: Toshiharu ICHINOSE, etc.

1. Class Subject

Biology A - Essential Cell Biology

2. Object and Summary of Class

Cells are the structural and functional units of living organisms. Understanding basics of cell biology is essential for studying all areas of life sciences and any related branches of natural sciences. The main objective of this course is to learn the essential principles of cell biology by learning how the living cells are made and operating from a molecular perspective: especially, how DNA, RNA and proteins cooperatively work inside the cells to allow the maintenance, replication and responses to stimuli. Together with Biology B, which will be held in the next spring, the textbook "Essential Cell Biology" will be covered.

3. Goal of Study

Upon finishing this course, students will have a solid grasp of structure of cells and how they replicate themselves, exert cellular functions and communicate with each other. More concretely, intracellular structure and molecular dynamics inside cells, mechanisms of DNA replication, repair and recombination, gene expression and its regulation, and cellular signaling will be introduced. In addition, research topics of the instructors, all of whom are young biologists/biochemists in FRIS, will be introduced so that students will have a glimpse of cutting-edge sciences.

To achieve this, students will need to read one or a half of a chapter of the textbook every week. Mini-quiz will be assigned in each class. Active participation, such as asking questions and discussion in the class, is strongly encouraged.

4. Contents and Progress Schedule

- 1) General introduction
- 2) Cells as the fundamental units of life and cell communities (Chap. 1, 20)
- 3) Chemical components of cells (Chap. 2)
- 4) Chemical reactions of cells 1 (Catalysis) (Chap. 3)
- 5) Chemical reactions in cells 2 (Biosynthesis) (Chap. 3)
- 6) DNA and chromosomes (structure & function) (Chap. 5)
- 7) DNA replication, repair, & recombination (Chap. 6)
- 8) From DNA to RNA (transcription & RNA processing) (Chap.7)
- 9) From RNA to proteins (translation & protein synthesis) (Chap. 7)
- 10) Control of gene expression 1 (transcriptional controls) (Chap.8)
- 11) Control of gene expression 2 (post-transcriptional controls) (Chap. 8)
- 12) Gene and genome evolution (Chap. 9)
- 13) Cell signaling 1 (principles and concepts) (Chap. 16)

14) Cell signaling 2 (receptors & cell-cell communication) (Chap. 16)

15) Final exam

5. Evaluation Method

Attendance, active participation and weekly mini-quiz (60%) and final exam (40%).

6. Textbook and References

Essential Cell Biology, 4th or 5th Edition Alberts B, Hopkin K, Johnson A, Morgan D, Raff M, Roberts K, Walter P WW Norton & Co 2018 Textbook

7. URL

8. Preparation and Review

Students are expected to spend 2-3 hours per week, reading relevant textbook material, and completing online assignments.

9. Practical business

10. Students must bring their own computers to class No

11. In Addition

1) This is a general, entry-level biology course, open to all students and compulsory for first-year FGL students in the AMB program. High school-level familiarity with basic organic chemistry and biology is expected, but not necessarily.

2) Japanese students and exchange students from any field of study are encouraged to enroll, knowing that this is an introductory course held in English.

3) Instructors are available for questions and consultation upon appointment.

<9> Introduction of Academic Learning

Class Schedule: Friday, 4th. (2 credits) Category: Foundations-Navigating Academia

Course Code: CB54209 Instructors: Yumiko WATANABE, etc.

1. Class Subject

Introduction to Academic Learning

2. Object and Summary of Class

2. Course Overview and objectives

This course aims to smooth the transition from studying at overseas high schools to Tohoku University. All classes will be conducted in the fall semester in person.

The course is designed to assist students in learning about Tohoku University and its contributions to society, about the responsibility of students as members of the academic community of Tohoku University, and to foster their motivation for education and research at Tohoku University.

Various course contents/activities such as lectures, field trips, discussions & presentations will help them in recognizing important differences in education between high school and university, including fundamental attitudes toward education and research in the university.

3. Goal of Study

The learning goals for students taking this course are as follows:

- Learn about the roles of the university and their contributions to society,
- Learn about the education, research, and facilities at Tohoku University,
- Learn about the responsibility of students as members of the academic community of Tohoku University,
- Foster the motivation for education and research at Tohoku University,
- Improve communication skills so as to more effectively deliver and understand ideas through class discussions and presentations.

4. Contents and Progress Schedule

Regular classes: 4th period every Friday

Class #	Date	Content	Instructor(s)
1	October 7	Orientation	by Y. Watanabe and others
2	October 14	A, B, C of being a Scholar-1	by M. Schroeder
3	October 21	A, B, C of being a Scholar-2	by M. Schroeder
4&5	October 22 (Sat.)	Field Trip to Tsunami Disaster Area	by Y. Watanabe & T. Koike
	October 28	No classes (University Festival)	
6	November 4	Academic Integrity	by T. Koike
7	November 11	History of Tohoku University-1	by M. Nakagawa
8	November 18	History of Tohoku University-2	by M. Nakagawa

9	November 25	History of Tohoku University-3 (Katahira Campus)	by M. Nakagawa
10	December 2	Internationalization at Tohoku University	by Y. Shimmi
11	December 9	Education and Society	by M. Kojima
12	December 16	Field Trip to "NanoTerasu"	by T. Koike & Y. Watanabe
13	December 23	Group Project-1 (Preparation)	all
14	January 6	Group Project-2 (Preparation)	all
15	January 20	Group Project-3 (Presentation)	all
16	January 27	Group Project-4 (Presentation)	all

5. Evaluation Method

- Attendance and class participation (40%)
- Submission of a short report about each class when it is assigned (<A4 one-page with using a provided template) (30%)
- Giving a group presentation about "Specific Topic" (30%)

6. Textbook and References

7. URL

8. Preparation and Review

Reading assigned reference materials and studying a specific topic before a class, preparing presentation materials for a group project; summarizing what you learn in the class and developing own idea

9. Practical business

10. Students must bring their own computers to class Yes

11. In Addition

<10> Mineralogy, Petrology & Geochemistry

Class Schedule: Thursday, 3rd. (2 credits) Category: Basics of Discipline-Basics of Earth and Space Science

Course Code: CB13216 Instructors: Breedlove Brian Keith

1. Class Subject

Earth Material Science

2. Object and Summary of Class

Often we think of rocks as just being rocks without understanding how they formed, their composition or purpose. This goes for the variety of materials that make up the world on which we reside. In this course, we examine how different minerals form and how to identify them and examine the applications of some of the naturally occurring materials.

3. Goal of Study

Goals of this courses include understanding how minerals form and how they are characterized. In addition, students will learn some uses of natural earth materials.

4. Contents and Progress Schedule

This schedule is still tentative...

Week

1. Introduction

2-3 Characterization methods

4-13 Formation of rocks

14-15 Uses, etc.

5. Evaluation Method

Attendance

Two reports: one will be handed in at midsemester and the other will be handed in at the end of the term.

6. Textbook and References

Earth Materials: Introduction to Mineralogy and Petrology 2ed. Klein C. and Philpots A. Cambridge University Press 2017 textbook

7. URL

8. Preparation and Review

read

9. Practical business

10. Students must bring their own computers to class If you

want to

11. In Addition

<11> Chemistry B

Class Schedule: Monday, 3rd. (2 credits) Category: Basics of Discipline-Basics of Chemistry

Course Code: CB43228 Instructors: Mott Derrick

1. Class Subject

Introduction to Physical Chemistry

2. Object and Summary of Class

Physical chemistry covers the topics of thermodynamics, which governs the flow of energy in a system. The relationship between heat, work, temperature and energy dictate chemical equilibrium and the behavior of atoms and molecules. This course will introduce the fundamentals of physical chemistry covering the topics of entropy, enthalpy and free energy, and will also introduce the technological areas where physical chemistry is used.

3. Goal of Study

Become familiar with the basics of physical chemistry.

Learn about the laws of thermodynamics and how they are used.

Learn about the interplay between preservation of energy, state of system, temperature and other topics.

4. Contents and Progress Schedule

1st: Introduction to chemical thermodynamics

2nd: Kinetic theory of gases

3rd: Kinetic theory of gases and gas equation of state

4th: The first law of thermodynamics: Introduction of gas volume change, work energy and enthalpy

5th: The first law of thermodynamics: Gas heat capacity, gas isothermal change and adiabatic change

6th: Quiz 1, The second law of thermodynamics: Introduction of Carnot cycle and entropy

7th: The second law of thermodynamics: Entropy and its microscopic meaning

8th: The second law of thermodynamics: Free energy and chemical potential

9th: Thermochemistry: Reaction heat, heat of formation, Hess's law, bond energy

10th: Quiz 2, Phase equilibrium: Water phase diagram, single component phase equilibrium

11th: Phase equilibrium: Liquid and solid vapor pressure, solution vapor pressure depression

12th: Phase equilibrium: Boiling point elevation, freezing point depression, osmotic pressure

13th: Chemical equilibrium: Equilibrium constant, standard free energy of formation

14th: Modern challenges: Conservation of energy in a thermodynamic

chemical system

15th: Physical chemistry used in advanced technological applications, summary and final examination

5. Evaluation Method

Evaluation is based on quizzes (20%), course participation (20%), homework assignments (20%), final examination (20%), and class attendance (20%).

6. Textbook and References

Fundamentals of Physics Halliday and Resnick Wiley Plus 2018
Wiley Plus

7. URL

8. Preparation and Review

Read the designated textbook sections to prepare for each class.

9. Practical business

10. Students must bring their own computers to class Yes

11. In Addition

<12> Calculus A

Class Schedule: Friday, 2nd. (2 credits) Category: Basics of Discipline-Basics of Mathematics

Course Code: CB52219 Instructors: Xavier DAHAN

1. Class Subject

Calculus of functions of the real variable

2. Object and Summary of Class

This is a classical first course of calculus for engineering students. It takes root in Calculus learnt in high-school and brings it to a more advanced/college level. The core of the course is differentiation and integration.

3. Goal of Study

Learn fundamental techniques of calculus of functions of the real variable, especially differentiation and integration.

Learn basic and fundamental applications.

Raise calculations skills. Become confident in conducting substantial calculations as met in Physics, Chemistry, Probability and Statistics, Engineering.

4. Contents and Progress Schedule

1. Introduction. Review of elementary functions.

2. Inverse functions (including some inverse trigonometric functions).

3. Limit of a sequence of numbers, definition and properties of real numbers.

4. Limit of a function and continuity. Intermediate value theorem.

5. Definition of the derivative of a function, differentiability.

6. Calculations of derivatives. Mean value theorem and applications to extrema problems

7. De L'Hospital's rule and practical evaluation of limits.

8. Midterm examination

9. Taylor's expansions, practical calculation.

10. Taylor-Lagrange remainder, application to estimation of the error.

Definition of the Riemann integral and the fundamental theorem of calculus.

11. Antiderivatives of elementary functions.

Technique of integration I-II: substitution and integration by parts.

12. Technique of integration III: integration of partial rational functions.

13. Technique of integration IV: trigonometric integrands and substitution

14. Area, volume, length.

15. Improper integrals

16. Final examination

5. Evaluation Method

A mix of the final and midterm exams, and reports.

6. Textbook and References

Shaum's outline. Calculus (sixth edition) Frank ayres. Elliott Mendelson
McGraw Hill

7. URL

8. Preparation and Review

Each new topic learnt is accompanied by "practice sheets" that illustrate and deepen each newly introduced material. A selection of these problems will be solved in class. Two to three reports will be assigned and serve to prepare the midterm and final exams.

9. Practical business

10. Students must bring their own computers to class No

11. In Addition

<13> Foundations of Calculus

Class Schedule: Tuesday, 4th. (2 credits) Category: Foundations-Natural Sciences

Course Code: CB24221 Instructors: Xavier DAHAN

1. Class Subject

Foundations of Calculus

2. Object and Summary of Class

Built upon Calculus learnt in high-school, this course prepares to more advanced/academic techniques of essential Calculus. Differential and Integral Calculus are the core of this course.

3. Goal of Study

Learn more advanced techniques of differentiation and integration.

Learn applications of differential and integral calculus.

Be confident to use differential and integral calculus in other courses like Physics and Chemistry, Probability and Statistics.

4. Contents and Progress Schedule

1. Review of essential mathematics notions.

2. Review of functions. Trigonometric functions, inverse trigonometric function.

3. Limits. Continuity.

4. Derivative of a function. Differentiation.

5. Derivatives of usual functions. Product, quotient and chain's rules.

6. Mean value theorem. Min/max problems.

7. De L'Hospital's rule. Computations of limits.

8. Mid-term examination.

9. Integration. Definition and Fundamental Theorem of Calculus.

10. Technique of Integration I: substitution

11. Technique of integration II: integration by parts.

12. Technique of integration III: Integration of rational functions.

13. Technique of integration IV: trigonometric integrands and substitutions

14. Length, area, volume, average.

15. Improper integrals.

16. Final examination.

5. Evaluation Method

A mix of midterm, final, and two to three reports, with heavier weight on the final, midterms and reports.

6. Textbook and References

Thomas' Calculus M.-D. Weir, J. Hass Pearson

7. URL

8. Preparation and Review

Each new topic learnt is accompanied by "practice sheets" that illustrate

and deepen each newly introduced material. A selection of these problems will be solved in class. Two or three reports will be assigned and will serve to prepare to the midterm and final exams.

9. Practical business

10. Students must bring their own computers to class No

11. In Addition

<14> Basic Japanese I

Class Schedule: Monday, 4th / Tuesday, 5th / Thursday, 2nd / Friday, 3rd. (4 credits)

Category: Languages-Japanese

Course Code: CB42209 Instructors: Natue SUGAYA, Atsuko UCHIYAMA, Masako HAYASHI

1. Class Subject

Japanese for beginners

2. Object and Summary of Class

This class will use Google Classroom.

Intended for students who will study Japanese for the first time. This class aims to help students acquire basic knowledge of Japanese language and enhance the four skills of speaking, listening, reading, and writing.

3. Goal of Study

Students will

- master elementary Japanese grammar, vocabulary, kana (hiragana, katakana) and approximately 150 basic kanji
- acquire minimum skills in speaking, listening, reading and writing for essential everyday situations
- achieve a proficiency level equivalent to JLPT N5.

4. Contents and Progress Schedule

1. Course orientation, Kana quiz
- 2-5. Lesson 1 New Friends
- 6-9. Lesson 2 Shopping
- 10-13. Lesson 3 Making a Date
- 14-18. Lesson 4 The First Date
- 19-23. Lesson 5 A Trip to Okinawa
- 24-28. Lesson 6 A Day in Robert's Life
29. Midterm exam (Kanji, Grammar, Listening)
30. Midterm exam (Speaking)
- 31-34. Lesson 7 Family Picture
- 35-39. Lesson 8 Barbecue
- 40-44. Lesson 9 Kabuki
- 45-49. Lesson 10 Winter Vacation Plans
- 50-54. Lesson 11 After the Vacation
- 55-58. Lesson 12 Feeling Ill
- 59-60 Summary

5. Evaluation Method

Homework assignments and class participation 50%, Quizzes 10%, Midterm and final exams 40%

6. Textbook and References

Genki 1, 3rd edition Banno et al. The Japan Times 2020 Textbook

7. URL

Genki-Online <https://genki3.japantimes.co.jp/>
The Japan Times, Book Club
<https://bookclub.japantimes.co.jp/en/book/b497763.html>

8. Preparation and Review

(1) Those who have no knowledge of the Japanese characters (hiragana, katakana) should learn them as a prerequisite to joining the program.

(2) 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 audio materials and learn vocabulary in advance. Read the grammar explanations in advance.

9. Practical business

10. Students must bring their own computers to class 必要

Yes

11. In Addition

Students are required to purchase the THIRD edition of GENKI 1.

<15> Sociology

Class Schedule: Tuesday, 1st. (2 credits) Category: Foundations-Humanities

Course Code: CB21222 Instructors: LIU Jing

1. Class Subject

Education and Sustainable Development Goals (SDGs)

2. Object and Summary of Class

The 2030 Agenda for Sustainable Development, which was adopted by the United Nations in 2015, has become a shared blueprint for peace and well-being of all human beings and the planet. Education, either as a goal and a means for achieving the global goal for sustainable development, has been given special attention by the global society.

This course provides a platform for participants to reconsider the relationship between education and sustainable development goals. It starts with an introduction to history and basic knowledge of sustainable development goals (SDGs) for global development by 2030. Then, it moves to understand the educational perspectives of the SDGs in global context, particularly in Asia. In the third part of the course, it discusses achievement and challenges of education and SDGs in diverse contexts in Asia. It closes by making group blueprints for education development in/for the SDGs in Asia by participants.

3. Goal of Study

Objectives of this subject are to enable students to:

1. obtain knowledge of sustainable development goals for the global society by 2030.
2. have a more comprehensive and more in-depth understanding of the relationship between education and sustainable development in the global community and the Asian context.
3. reconsider critically about the current policies and practices of education in/for sustainable development
4. raise blueprints for educational development in/for SDGs in Asia.

4. Contents and Progress Schedule

Session 1: Orientation & Introduction to Sustainable Development Goals (SDGs): A historical review

Session 2: Introduction to Sustainable Development Goals (SDGs): Understanding 17 SDG Goals

Session 3: Introduction to SDG 4

Session 4: Inequality in education & SDGs

Session 5: Quality education & SDGs

Session 6: Teachers' education & SDGs

Session 7: Group presentations: Inclusive and equitable quality education in Asia

Session 8: Higher education & SDGs

Session 9: Group discussion: Transforming teaching and learning for

sustainability in Asia

Session 10: Alternative education & SDGs

Session 11: SDG 4 in Japan

Session 12: Education as a means for SDGs

Session 13: Building a new social contract for education

Session 14: Final presentation: How can we contribute to SDGs through education?

Session 15: Final presentation: How can we contribute to SDGs through education?

5. Evaluation Method

Participation (50%); Group works (30%); Reports and presentations (20%)

6. URL

1. United Nations (2015) Transforming our World: The 2030 Agenda for Sustainable Development. New York: United Nations. (<https://sustainabledevelopment.un.org/post2015/transformingourworld/publication>)

2. UNESCO (2021) Global Education Monitoring Report

7. Preparation and Review

1. The session time is limited and therefore self-directed learning is important. Students are required to prepare and review for each class.

2. Students are encouraged to collect information and topics related to the content of the class using newspapers, books, internet and other media.

3. Group-based study and discussion are highly recommended.

8. Students must bring their own computers to class

Students may need to bring their own laptops for face-to-face discussion/activities.

Announcement will be made in advance.

9. In Addition

1. Materials are provided via Google Classroom.

2. Positive participation in classes is expected.

3. If you have to be absent from class, you must notify the lecturer in advance.

4. Office hours: Please make an appointment in advance via e-mail or other means. The contact information for the lecturer will be given in class.