JYPE 2016-2017
Fall Semester
Course Description

Tohoku University
Institute for Excellence in Higher Education

Contents

Japanese 1

Instructor: Professor Sekiko Sato and staffs

Offices: Sato: Rm 518, Institute for Excellence in Higher Education Building (Kawakita Joint Building)

Other staffs: Rm 106, International Exchange Building

Contact e-mail address: sekiko.sato.e8@tohoku.ac.jp

Japanese 1 is for novice learners. When you successfully complete the course, you can expect to pass N5 of the Japanese Language Proficiency Test (http://www.jlpt.jp/). The course begins with the study of hiragana, katakana and pronunciation and then covers all 25 Lessons of "Minna no Nihongo Elementary Japanese I" published by 3A Network. The course grade will be based on attendance, participation and in-class quizzes (50%) and the final examination (50%).

[Oct 3 (Mon) Orientation & Placement test]

The classes (B110a/B110b/B110c/B110d) will be held on every Monday and Thursday (except a few national holidays and winter vacation) and each class will generally cover 1 lesson. The schedule below is subject to change.

01. OCT 6 (Thu) HIRAGANA & KATAKANA

02. OCT 13 (Thu) L.1-1

N1 *wa* N2 *desu*

03. OCT 17 (Mon) L.1-2 / L.2

N1 *wa* N2 *ja arimasen* N1 *wa* N2 *desuka* N *mo* N1 *no* N2 *…san*

Kore/sore/are　*Kono/sono/ano*　*Soodesu*　*...ka, ...ka*　*Soudesu ka*

04.　OCT 20 (Thu) L.3 ～ JAN 26 (Thu) L.25

L.3

Koko/soko/asoko　*Doko/dochira*　N *wa* place *desu*　N1 *no* N2　*O…*

L.4

Ima ...ji ...fun desu　V-*masu/masen/mashita/masendeshita*　N(time) *ni* V
N1 *kara* N2 *made*　N1 *to* N2　*…ne*

L.5

N(place) *e ikimasu*　*Doko e mo ikimasen/ikimasendeshita*　N(vehicle) *de ikimasu*
N(person/animal) *to* V　*Itsu*　*…yo*

L.6

N *o* V　N *o shimasu*　*Nani o shimasu ka*　N(place) *de* V　V *masen ka*　V *mashoo*

L.7

N(tool/means) *de* V　N1(person) *ni* N2 *o agemasu*　N1(person) *ni* N2 *o moraimasu*
Moo V *mashita.*

L.8

N *wa na*-adj *desu*　N *wa i*-adj *desu*　*…ga，…*　*Totemo*　*Amari*
N *wa doodesu ka*　N1 *wa donna* N2 *desu ka*　*Soodesu ne*

L.9

N *ga arimasu*　N *ga wakarimasu*　N *ga sukidesu/kiraidesu*　*Donna* N　*Yoku*
Daitai　*Takusan*　*Sukoshi*　*Amari*　*Zenzen*　*…kara，…*　*Dooshite*

L.10

N *ga arimasu/imasu*　Place) *ni* N *ga arimasu/imasu*　N *wa* place *ni arimasu/imasu*
N1(thing/person/place) *no* N2(position)　N1 *ya* N2

L.11

How to say numbers　Quantifier(period)*ni* ...*kai* V　Quantifier *dake* /N *dake*

L.12

Tense of noun sentences and *na*-adjective sentences　Tense of *i*-adjective sentences　N1 *wa* N2 *yori* adj *desu*　N1 *to* N2 *to dochira ga* adj *desu ka*　N1 *no naka de dore ga ichiban* adj *desu ka*

L.13

N *ga hoshii desu*　V *masu*-form *tai desu*　N(place) *e* V *masu*-form *ni ikimasu*　*Dokoka*　*Nanika*　*Go*～

L.14

Verb groups　V *te*-form　V *te*-form *kudasai*　V *te*-form *imasu*　V *masu*-form *mashoo ka*　N *ga*, V　*Sumimasen ga*

L.15

V *te*-form *mo ii desu*　V *te*-form *wa ikemasen*　V *te*-form *imasu*　N *ni* V

N1 *ni* N2 *o* V

L.16

V1 *te*-form *kara*, V2　N1 *wa* N2 *ga* adj　N *o* V　*Dooyatte*　*Dore*　*Dono* N

L.17

V *nai*-form　V *nai*-form *naide kudasai*　V *nai*-form *nakereba narimasen*　V *nai*-form *nakutemo ii desu*　N(time) *made ni* V

L.18

Dictionary form of verbs　N/V-dictionary form *koto ga dekimasu*　*Watashi no shumi wa* N/V-dictionary form *koto desu*　V1 dictionary form *mae ni* V2　*Nakanaka*　*Zehi*

L.19

Verb *ta*-form　V *ta*-form *koto ga arimasu*　V *ta*-form *ri*, V *ta*-form *ri shimasu*
i-adj *ku narimasu*　*na*-adj *ni narimasu*　N *ni narimasu*

L.20

Polite style and plain style　Conversation in the plain style

L.21

Plain form *to omoimasu*　Sentences/plain form *to iimasu*　Plain form *deshoo*
N1(place) *de* N2 *ga arimasu*　N(occasion) *de*　N *demo* V　V*nai*-form *to*…

L.22

Noun modification　V-dictionary form *jikan/yakusoku/youji*

L.23

V dictionary form/V *ta*-form *toki,* ...　V dictionary form *to*, ...　N *ga* adj

L.24

Kuremasu　V *te*-form *agemasu/moraimasu/kuremasu*　N1 *wa* N2 *ga* V

L.25

V *ta*-form *ra*, ...　V *nai*-form *nakute mo*　*Moshi*　*Ikura ...temo/demo*

05. JAN 30 (Mon)　EXAMINATION

Japanese 2

Instructor: Professor Sekiko Sato and staffs

Offices: Sato: Rm 518, Institute for Excellence in Higher Education Building (Kawakita Joint Building)

Other staffs: Rm 106, International Exchange Building

Contact e-mail address: sekiko.sato.e8@tohoku.ac.jp

Japanese 2 is for those who have finished Japanese 1 or those who have equal proficiency (i.e., Level II according to the placement test for JAPANESE LANGUAGE PROGRAM AT KAWAUCHI). When you successfully complete this course, you can expect to pass N4 of the Japanese Language Proficiency Test (http://www.jlpt.jp/). The course covers all 25 Lessons of "Minna no Nihongo Elementary Japanese II" published by 3A Network. The course grade will be based on attendance, participation and in-class quizzes (50%) and the examinations (50%).

[Oct 3 (Mon) Orientation & Placement test]

The classes (B210a/B210b) will be held on every Monday and Thursday (except a few national holidays and winter vacation) and each class will generally cover 1 lesson. The schedule below is subject to change.

01. OCT 6 (Thu) L.26 ～ NOV 21 (Mon) L.37

L.26

...n desu　V *te*-form *itadakemasen ka*　Interrogative V *ta*-form *ra ii desu ka*
N *wa suki/kirai/joozu/heta desu*

L.27

Potential verbs　*Miemasu*　*Kikoemasu*　*Dekimasu*　*...shika*　N *wa* (contrast)

L.28

V1 *masu*-form *nagara* V2　V *te*-form *imasu*　plain form *shi*, ...　*Sorede*　…toki

L.29

V *te*-form *imasu*　V *te*-form *shimaimashita*　N(place) *ni ikimasu/kimasu/kaerimasu*
Dokokade/Dokokani

L.30

V *te*-form *arimasu*　V *te*-form *okimasu*　*Mada* ＋ affirmative　…toka

L.31

Volitional form　V dictionary form *tsumori desu*　V *nai*-form *tsumori desu*
V dictionary form/N *no yotee desu*　*Mada* V *te*-form *imasen*

L.32

V *ta*-form *hoo ga ii desu*　V *nai*-form *hoo ga ii desu*　*...deshoo*　*...kamo shiremasen*
V *masu*-form *mashou*

L.33

Imperative and prohibitive forms　X *wa* Y *to yuu imi desu*
Sentence/plain form *to itte imashita /to tsutaete itadakemasen ka*

L.34

V1 *ta*-form *toori ni* , V2　N1 *no toori ni* , V2　V1 *ta*-form *ato de*, V2　N 1*no atode* ,V2　V1 *te*-form V2　V1 *nai*-form *naide* V2

L.35

Conditional form　Interrogative V conditional form *iidesu ka*　N *nara, ...*

L.36

V1 dictionary form *yoo ni,* V2　. V1 *nai*-form *nai yoo ni,* V2　*...yoo ni narimasu*
...yoo ni shimasu

L.37

Passive verbs　N1(person1) *wa* N2(person2) *ni* passive V
N1(person1) *wa* N2(person2) *ni* N3 o passive V　N *kara*/ N *de tukurimasu*
N1 *no* N2　*Kono/sono/ano* N(position)

02. NOV 24 (Thu)　MIDTERM EXAMINATION

03. NOV 28 (Mon) L.38 ～ JAN 26 (Thu) L.50

L.38

No as a nominaliser　V dictionary form *no wa /no ga* adj *desu*
V plain form *no o shitte imasuka*　V/*i*-adj/*na*-adj/ N1*na no wa* N2 *desu*

L.39

V *te*-form, ...　V/*i*-adj/*na*-adj/ N1*na node*, ...　Tochuu de

L.40

V/*i*-adj/*na*-adj/N *ka, ...*　*... ka doo ka*, ...　V *te*-form *mimasu*　*...deshou ka*

L.41

Expression for giving and receiving　Giving and receiving of actions
V *te*-form *kudasaimasen ka*　N *ni* V

L.42

V dictionary form/N *no tame ni*, ...　V dictinary form *no/* N *ni* ...　*...ni yotte*

L.43

…soudesu　V *te*-form *kimasu*　V *te*-form *kuremasenn ka*

L.44

V *masu*-form/*i*-adj/*na*-adj *sugimasu*　V *masu*-form *yasui/nikui desu*
N1 o *i*-adj *ku /na*-adj *ni shimasu*　N *ni shimasu*

L.45

V/ *i*-adj/*na*-adj *baai wa*, ...　V/ *i*-adj/*na*-adj *noni*, ...

L.46

V dictionary form *tokoro desu*　V *te*-form *iru tokoro desu*　V *ta*-form *tokoro desu*
V *ta*-form *bakari desu*　V dictionary form/*i*-adj/*na*-adj/N *no hazu desu*

L.47

Plain form *soo desu*　V plain form/*i*-adj/*na*-adj/N *no yoo desu*

L.48

Causative verbs　Causative V *te*-form *itadakemasen ka*

L.49

Keigo (Honorific expressions)　*Sonkeigo*(Respectful expressions)　*...mashite*

...masu node

L.50

Kenjougo(Humble espressions)

04. JAN 30 (Mon)　FINAL EXAMINATION

Japanese 3

Instructor: Professor Sekiko Sato and staffs

Offices: Sato: Rm 518, Institute for Excellence in Higher Education Building (Kawakita Joint Building)

Other staffs: Rm 106, International Exchange Building

Contact e-mail address: sekiko.sato.e8@tohoku.ac.jp

Japanese 3 is for those who have completed Japanese 2 in the preceding semester or those who have equal proficiency (i.e., Level III according to the placement test for JAPANESE LANGUAGE PROGRAM AT KAWAUCHI). When you successfully complete this course, you can expect to pass N3 of the Japanese Language Proficiency Test (http://www.jlpt.jp/). Japanese 3 consists of the following four classes, and you must take all the four classes to receive the grade for the course:

[Oct 3 (Mon) Orientation & Placement test]

G310 (Grammar):

Learn and practice post-beginning level grammatical patterns. The course materials are provided by the instructor.

S310 (Speaking):

Learn how to convey one's ideas and opinions orally in Japanese by having discussions and presentations on familiar and current topics in class. The course materials are provided by the instructor.

R310 (Reading):

Practice reading easy but authentic reading materials to familiarize yourself with written Japanese and boost up your reading comprehension ability. The textbook is "Daigaku/Daigakuin Ryuugakusei no Nihongo 1" published by ALC.

P310 (Practice):

Practice and utilize what you have learned in grammar, reading and speaking classes in actual communicative contexts.

Each class has its own class and exam schedule and grading policy, which are to be announced on the first day of the class. Japanese 3 grade will be based on the average score of the four classes.

Japanese 4

Instructor: Professor Sekiko Sato and staffs

Offices: Sato: Rm 518, Institute for Excellence in Higher Education Building (Kawakita Joint Building)

Other staffs: Rm 106, International Exchange Building

Contact e-mail address: sekiko.sato.e8@tohoku.ac.jp

Japanese 4 is for those who have completed Japanese 3 in the preceding semester or those who have equal proficiency (i.e., Level IV according to the placement test for JAPANESE LANGUAGE PROGRAM AT KAWAUCHI). When you successfully complete this course, you can expect to pass N2 of the Japanese Language Proficiency Test (http://www.jlpt.jp/). Japanese 4 consists of the following six classes, and you must take FOUR of them to receive the grade for the whole course:

[Oct 3 (Thu) Orientation & Placement test]

G410 (Grammar):

Learn and practice upper-intermediate level grammatical patterns. The textbook is "Chuukyuu o Manabou: Nihongo no Bunkei to Hyougen56 Chuukyu-zenki" published by 3A Network .

S410 (Speaking):

Learn how to convey one's ideas and opinions orally in Japanese by having discussions and presentations on familiar and current topics in class. You are required to write a resume and short reports. The course materials are provided by the instructor.

R410 (Reading):

Practice reading easy but authentic reading materials to familiarize yourself with written Japanese and boost up your reading comprehension ability. The textbook is "Daigaku/Daigakuin Ryuugakusei no Nihongo 3: Ronbun Dokkai hen" published by ALC.

P410 (Practice):

Practice and utilize what you have learned in grammar, reading and speaking classes in actual communicative contexts.

CP400 (Collaborative Project for International and Japanese Students (Art))

This course provides you with a task to work with international andJapanese students. We are going to visit Miyagi Museum of Art several times, and learn from curator. If you are interested in art museum, or working with people from different backgrounds, this course gives you the opportunity. In this course, you can improve presentation skills as well.

SP400 (Designing for Multicultural Short Program):

In collaboration with Japanese students, we will be planning an educational tour for foreign students visiting Sendai during their short-term program (approximately two weeks). In the tour, foreign students will experience Sendai, the Tohoku region, and Japanese culture. We will research examples of short-term programs in various countries, and acquire a multicultural perspective that will allow both Japanese students and foreign students to assess the program from both the viewpoint of visitors and hosts.

Each class has its own class and exam schedule and grading policy, which are to be announced on the first day of the class. Japanese 4 grade will be based on the average score of the four classes you choose.

Course Title	Japanese Culture A
Semester	2016 Fall
Credit	2
Instructor	Part-time lecturer Koji SHIDARA
E-mail	kojishidara@gmail.com
Class Hours / Period	Wednesday, 10:30-12:00 October 5, 2016-January 18, 2017
Room	C206 Kawauchi-Kita Campus

Course Objectives

An exploratory culture course, Japanese Culture A is offered for foreign students to learn about and share insights into various aspects of the living culture of Japan with some emphasis placed on the effects of the Great East Japan Earthquake of 2011 and the rebuilding effort thereof. Because the students come from all around the globe with widely varying cultural backgrounds, it is expected that they learn not only about the Japanese culture but about the sense of value of the other students as well.

Course Summary

The course comprises three basic approaches: discussion of certain cultural aspects of the country; reading literature related with the 2011 earthquake and tsunami; field trips to places of cultural significance. These components are designed so that they complement each other. Japanese Culture A and C courses overlap in part due to the nature of certain special events taking place during the semester.

Learning Goals

Five years after the 2011 earthquake and tsunami, the rebuilding effort continues in Tohoku Region. Students will gain a new perspective of the culture of this nation by witnessing and taking part in some of the dynamic interactions of the old and new elements in the reconstructing process.

Course Schedule

Oct. 5	1. What's in a name?—A glimpse into the meaning of Japanese names
Oct. 12	2. Overview of the history of Tohoku
Oct. 15	3. Field trip to Nenoshiroishi's Kamuri Festival and Mt. Izumi (Saturday)

Course Schedule	
Oct. 19	4. The story of the Sendai Castle
Oct. 26	5. Hiking the Sendai Castle grounds
Nov. 2	6. Building the Millennium Hope Hills in Iwanuma City
Nov. 5	7. Exploring the Millennium Hope Hills in Iwanuma City (Saturday)
Nov. 9	8. Sendai's 17th-century mission to the Vatican
Nov. 16	9. Surviving the 2011 tsunami
Nov. 30	10. Coming to terms with the 2011 tsunami: Reading *Warm Hands*
Dec. 3	11. Field trip to Ishinomaki. Destinations include Ishinomaki-Higashi Nursery School, Dogenin Temple, Sant Juan Bautista Park, tsunami-hit communities.
Dec. 7	12. Significance of Sendai's mission to the Vatican
Dec. 14	13. Visiting the Sendai City Museum—Seeing artifacts from the Vatican
Jan. 11	14. Student presentation
Jan. 18	15. Student presentation
Course Grading	
Evaluation is based on class participation, weekly web forum assignments, the final paper and presentation.	
Textbook	
Warm Hands, Miki Onosaki, Koji Shidara (translation), Tokyo, Pantaka, 2013 *Surviving the 2011 Tsunami: 100 Testimonies of Ishinomaki Area Survivors of the Great East Japan Earthquake*, Editorial Office of The Ishinomaki Kahoku, Tokyo, Junposha, 2014	

Course Title	Japanese Culture C
Semester	2016 Fall
Credit	2
Instructor	Part-time lecturer Koji SHIDARA
E-mail	kojishidara@gmail.com
Class Hours / Period	Wednesday, 13:00-14:30 October 5, 2016-January 18, 2017
Room	C202 Kawauchi-Kita Campus

Course Objectives

An exploratory culture course, Japanese Culture C is offered for foreign students to learn about and share insights into various aspects of the living culture of Japan with some emphasis placed on the Tohoku locale. Because the students come from all around the globe with widely varying cultural backgrounds, it is expected that they learn not only about the Japanese culture but about the sense of value of the other students as well.

Course Summary

The course comprises three basic approaches: discussion of certain cultural aspects of the country; reading modern Japanese literature; field trips to places of cultural significance. These components are designed so that they complement each other. Japanese Culture A and C courses overlap in part due to the nature of certain special events taking place during the semester.

Learning Goals

Students will come to know Tohoku Region intimately in a kind of context that allows them to see the region in relation to the nation and the rest of the world.

Course Schedule	
Oct. 5	1. What's in a name?—A glimpse into the meaning of Japanese names
Oct. 12	2. Overview of the history of Tohoku
Oct. 15	3. Field trip to Nenoshiroishi's Kamuri Festival and Mt. Izumi (Saturday)
Oct. 19	4. Music and anime : Popular styles of expression
Oct. 26	5. Reading : "The Bears of Nametoko" by Kenji Miyazawa
Nov. 2	6. Building the Millennium Hope Hills in Iwanuma City
Nov. 5	7. Exploring the Millennium Hope Hills in Iwanuma City (Saturday)
Nov. 16	8. The story of a last samurai : Tamamushi Sadayu
Nov. 26	9. Visiting the Rinnoji Temple in Kitayama, Sendai City (Saturday)
Nov. 30	10. Reading: "The Flower-eating Crone" by Fumiko Enchi
Dec. 7	11. Exploring changing styles of art—Visiting the Miyagi Museum of Art
Dec. 14	12. "We are no traitors!"—Preparing for the fieldwork in Shiroishi City
Dec. 17	13. Field trip to Shiroishi City: Visiting the Shiroishi Castle; experiencing the noh theater; meeting sword-making master (Saturday)
Jan. 11	14. Student presentation
Jan. 18	15. Student presentation
Course Grading	
Evaluation is based on class participation, weekly web forum assignments, the final paper and presentation.	
Textbook	
Course materials will be provided as handouts.	

Course Title	Matematics A
Semester	2016 Fall
Credit	2
Instructor	Professor Tatsuya TATE Assoc. Professor Yuu HARIYA Assoc. Professor Takuya YAMAUCHI
E-mail	tate@m.tohoku.ac.jp hariya@math.tohoku.ac.jp tyamauchi@m.tohoku.ac.jp
Class Hours / Period	Friday. 8:50—10:20 October 7, 2016—Febrary 3, 2017
Room	Kawauchi Campus, Room C201

Course Objectives

The aim of this course is to discuss various topics on modern mathematics. Each lecturer gives 5 lectures of each topic. The outline of the course is as follows:

I. Basics of probability theory (Hariya)

II. Birch-Swinnerton-Dyer conjecture (Yamauchi)

III. Introduction to Discrete Geometric Analysis (Tate)

Course Summary

Course content

I. (1) First we introduce the notion of probability spaces. A probability space is defined as a measure space with total measure one. Each element in the associated sigma-field is called an event. Students are assumed to be fairly familiar with the fundamentals of measure theory (the theory of Lebesgue integrals).

(2) We introduce the notion of random variables (r.v.'s). An r.v. is a measurable function defined on the probability space. Several examples of r.v.'s are given.

(3)(4) Associated with the notion of r.v.'s, two important quantities, the expected value and variance, are introduced. Some concrete computations of them are shown.

(5) We introduce the notion of independence, which is very important in probability theory. We start with the independence of events, and then extend it to that of r.v.'s. These three notions, expected value, variance and independence, play an essential role in formulating limit theorems in probability theory, some of which will be introduced in Mathematics B.

II. In this middle course, we will learn the statement of Birch-Swinnerton-Dyer conjecture which is one of the Millennium Prize Problems in number theory.
(1) We will study the rational points on the unit circle and give an explicit parametrization.
(2) We will define an addition law on the unit circle and we discuss about Weyl's equidistribution theorem on the points obtained from the multiplications of a given point.
(3) We will learn basics of elliptic curves which is one of interesting next objects as an algebraic curve.
(4) We will define an addition law on elliptic curves.
(5) We will study the statement of Birch-Swinnerton-Dyer conjecture.

III. The purpose of this part of series of lectures is to give some ideas in the area of discrete geometric analysis. First, we consider a famous problem on the squared rectangles. A squared rectangle is a rectangle divided into small squares. In 1903, Dehn showed that the ratio of lengths of two sides of the rectangle having such a division into small squares must be a rational number. One of its proofs is based on properties of the discrete Poisson equation on a finite graph, which is a discrete analogue of well-known partial differential equation called the Poisson equation.
(1) In the first lecture, squared rectangles will be introduced and the connection between this and graph theory will be explained.
(2) Dehn’s theorem will be proved in the second lecture.
(3) The proof of Dehn’s theorem is somehow related to the notion of (co)homology theory. Cohomology groups for graphs and its properties will be explained in the third lecture.
(4) In the fourth lecture, the homology groups for the graphs will be introduced. This is a dual notion to cohomology groups and is important for analyzing structures of graphs.
(5) Indeed, a famous theorem, called matrix-tree theorem, on the number of spanning trees of a given finite graph can be formulated in terms of (co)homology theory. The details on this theorem will be explained in the final lecture.

Preparation for lectures
Students are assumed to be familiar with elementary multi-variable calculus and linear algebra.

Obligation Students should attend each class and should submit some reports. Problems for reports will be given in the class. Further study Handouts and/or some references will be given in the lectures, which will help students to study more about the topics.
Learning Goals
Students will be knowledgeable about various topics in mathematics, especially in number theory, geometry and probability theory.

Course Schedule		
Oct. 7	Hariya	1. Probability spaces
Oct. 14	Hariya	2. Random variables
Oct. 21	Hariya	3. Expectation and variance 1
Nov. 4	Hariya	4. Expectation and variance 2
Nov. 11	Hariya	5. Independence
Nov. 18	Yamauchi	6. The rational points on the unit circle
Nov. 25	Yamauchi	7. An addition law on the unit circle and Weyl's equidistribution
Dec. 2	Yamauchi	8. On elliptic curves
Dec. 9	Yamauchi	9. An addition law on elliptic curves
Dec. 16	Yamauchi	10. On Birch-Swinnerton-Dyer conjecture
Jan. 6	Tate	11. Squared rectangles and Dehn’s theorem
Jan. 20	Tate	12. Proof of Dehn’s theorem
Jan. 27	Tate	13. Cohomology and harmonic forms on finite graphs
Jan. 31	Tate	14. Homology on graphs and its structure
Feb. 3	Tate	15. Number of spanning trees: a version of matrix-tree theorem
Course Grading		
The course grades will be based on attendance and reports.		
Textbook		
Textbooks are not assigned in advance.		

Course Title	Introductory Courses of Experimental Research in Physics III
Semester	Fall
Credit	2
Instructor	Masayuki Yoshizawa, Professor, Department of Physics, Graduate School of Science
E-mail	m-yoshizawa@m.tohoku.ac.jp
Time and Day	Monday and Tuesday, 13:00-16:10
Place	Aobayama Campus

Course Objectives and Outline

Experiments are very important for development of new physics. Based on basic knowledge of physics, students experience introductory experiments of leading researches.

Learning Goal

The goal of this program is to let students experience basic research of experimental physics.

Course Content

Students are required to perform two subjects from the flowing list.

(1) The first subject (November 7 - December 6)
- (1-a) Experimental Nuclear Physics
- (1-b) Intermediate Energy Nuclear Physics
- (1-c) Low Temperature Quantum Physics
- (1-d) Surface Physics

(2) The second subject (December 12 - January 24)
- (2-a) Experimental Particle Physics (Research Center for Neutrino Science)
- (2-b) Macroscopic Quantum Phenomena
- (2-c) Solid-State Quantum Transport

Course Schedule
1） Entry and assignment of subjects Students are requested to contact Prof. M. Yoshizawa by Email (m-yoshizawa@m.tohoku.ac.jp) for entry to the course by Oct. 11. Assignment of subjets is done by office considering capacity and request of the students. 2) November 7 － December 6 The first subject. 3) December 12 – January 24 The second subject.
Assessment Criteria
Grades of the course will be assigned as follows: AA…….. Excellent (90-100%) A……. Good (80-89%) B……. Fair (70-79%) C……. Passing (60-69%) D……. Failure (0-59%) Students will be evaluated based on: class attendance, presentations, and reports.
Textbook
Note

Course Title	Organic Chemistry
Semester	Fall
Credit	2
Instructor	Associate Professor Eunsang Kwon
E-mail	ekwon@m.tohoku.ac.jp
Class Hours / Period	Wednesday, 14:40-16:10 October 5, 2016 – February 2, 2017
Room	Multimedia Education and Research Complex (ICL 3, M101) and International Exchange Building (Room 105) *Except the final examination (Feb. 2, 2017), the lecture will be held in the Multimedia Education and Research Complex.

Course Objectives

This course focuses on the fundamentals of organic chemistry.

Topics include chemical bonding and structure, stereochemistry, acids and bases, and organic reactions.

In this course, students will learn the structure and physical properties of organic molecules using a molecular modeling program on a computer system.

Course Summary

Fundamentals of chemical structure and bonding, organic compounds, stereochemistry, organic reactions, and molecular orbitals for organic molecules.

Learning Goals

This course is designed to help students understand the basics of chemical reactions and be able to apply them to typical organic reactions.

Course Schedule	
Oct. 5	1. Structure and Bonding
Oct. 12	2: Polar Covalent Bonds: Acids and Bases
Oct. 19	3: Organic Compounds: Alkanes and Their Stereochemistry
Oct. 26	4: Organic Compounds: Cycloalkanes and Their Stereochemistry
Nov. 2	5: Alkenes: Structure and Reactivity
Nov. 9	6: Alkenes: Reactions and Synthesis
Nov. 16	7: Alkynes: An Introduction to Organic Synthesis
Nov. 30	8: Stereochemistry
Dec. 7	9: Organohalides
Dec. 14	10: Reactions of Alkyl Halides: Nucleophilic Substitutions and Eliminations
Dec. 21	11: Structure Determination: Nuclear Magnetic Resonance and Infrared Spectroscopies
Jan. 11	12: Conjugated Compounds and Ultraviolet Spectroscopy
Jan. 18	13: Benzene and Aromaticity
Jan. 25	14: Chemistry of Benzene: Electrophilic Aromatic Substitution
Feb. 2	15: Final Exam.
Course Grading	
Students will be evaluated based on: class attendance, short tests, and a final examination.	
Textbook	
Organic Chemistry, 8th ed., by John McMurry, Publisher: CENGAGE Learning, 2011 (ISBN-10: 0840054440, ISBN-13: 9780840054449, previous edition is usable).	

Dynamics of the Earth

Prof. Motohiko MURAKAMI
Contact address: motohiko@m.tohoku.ac.jp
Assosiate Prof. Takahiro KURIBAYASHI
t-kkuri@m.tohoku.ac.jp
Assist.Prof. Tatsuya SAKAMAKI
sakamaki@m.tohoku.ac.jp
Assist.Prof. Yoshihiro Furukawa
yoshihiro@m.tohoku.ac.jp
Assist.Prof. Akio GOTO
ak-goto@cneas.tohoku.ac.jp

PLACE: International Exchange Building, R115
(Some classes will be given at Geology building@Aoba-yama campus)
TIME: 10:30-12:00 (10:45-12:00 when held at Aoba-yama campus)

This is an introductory geology program to understand the Earth dynamics. The constituents of the Earth (minerals and rocks, and their geochemical roles) and basic mineralogy, petrology, volcanology and experimental mineral physics will be taught, and the structure of the Earth and driving forces for the Earth dynamics (volcanic activities, earthquake, hot spring, etc) will be discussed. A short field trip around Tohoku Univ., a university museum tour, and an ultra high-pressure laboratory tour are planned.
Discussions during the classes will be encouraged.
Attendance, discussion in the classes, and a brief examination will be considered for the evaluation.

Schedule

01 Oct.4 Introduction to Earth's history (Furukawa)
(Formation of planetary system, ocean, and continents)

02 Oct.11 Introduction to volcanology (Goto)

03 Oct.18 No class

04 Oct. 25 Origin of life and astrobiology (Furukawa)

05 Nov.1 No Class

06 Nov.8 Co-evolution of Life and Earth (Furukawa)
(Photosynthesis and the rise of Earth's oxygen level, birth of aerobe, mass extinction, global warming)

07 Nov.15 Physics of magma transport (Goto)

08 Nov.22 Viscosity of magma and its influences on volcanic activity (Goto)

09 Nov.29 No class

10 Dec.6 Introduction to Mineralogy and Crystallography (Kuribayashi)

11 Dec.13 Classification of Minerals (Kuribayashi)

12 Dec. 20 University Museum Tour (Kuribayashi)@Aoba-yama campus

13 Jan.10 Earth's Deep Structure Part I (Sakamaki)

14 Jan.17 Earth's Deep Structure Part II (Sakamaki)

15 Jan.24 Water circulation / Deep magma (Sakamaki)

Ecology and evolution

Contact address: hikosaka@m.tohoku.ac.jp (Prof. Hikosaka)
sci-sien@grp.tohoku.ac.jp (Student Support Section,School of Science)
Place: Room 115 at International Exchange Building.
Time: 8:50 ― 10:20 every Tuesday

This course aims to give students some basic concepts on vegetation, ecology and evolution using materials lecturers have been studying. Students are required to attend the class and to submit an essay dealing with a topic covered in one of the lectures. Do not skip class without notifying the lecturer by e-mail in advance.

October 11
Global change and plants (K. Hikosaka)
Atmospheric CO_2 concentration is expected to increase in future. Plants are an important component of ecosystem as they absorb CO_2 by photosynthesis. So far a number of experiments have been conducted to elucided plant responses to elevated CO_2. In this course, I introduce general knowledge and our recent findings on plant responses to elevated CO_2.

October 18
Floral ecology of plants (S. Sakai)
Animal pollinated plants attract pollinators by presenting visual flowers and rewarding nectar and pollen, and the strategy of attracting pollinators has been widely diversified. I lecture the adaptive significances of flowers: on the function of floral organs and how flowers attract pollinators.

October 25
An introduction of Ecological Stoichiometry (J. Urabe)
This lecture introduces you a unified basic theory on balance of chemical elements in individual performance and biological interactions, which is useful to understand how individual fitness is related with ecosystem processes.

November 1
Evolution (M. Kawata)
The evolution is a change over time in the proportions of individual organisms differing genetically in one or more traits. Evolution is the most important factor creating biological diversity. The purpose of this lecture is to explain basic mechanisms for evolution within populations and evolution of creating species.

November 8
Reproductive isolation of plant species (M. Maki)
Reproductive isolation is a mechanism interfering gene flow between different species, and maintaining unity of species. Many kinds of reproductive isolations are known in wild plant species. In this talk, I will introduce some of them by showing examples and discuss plant speciation, the process by which different species arise, from the view of development of reproductive isolations.

November 15
Gene and genome duplication (T. Makino)
I give a lecture focusing on animal evolution driven by gene and genome duplication. Gene duplication frequently occurs in eukaryotic genomes and plays a major role in evolution. Whole genome duplication has made a significant contribution to vertebrate evolution.

November 22
Heterospecific mating interactions (W. Makino)
Heterospecific mating interactions are important for the ecology and evolution of co-occurring species. Genetic introgression between species could occur when the level of heterotrophic mating interactions is high. Even when no hybrid offspring are produced between species, heterospecific mating interactions can still be important because conspecific may suffer from fertilization limitation through the reproductive interference by heterospecific, which in turn negatively affect the population dynamics of conspecific. Theoretical studies show that the reproductive interference may work in nature as an efficient mechanism to cause habitat partitioning in either time or space between species (sexual competition).

November 29
Island biology (S. Chiba)
Fauna and flora of oceanic islands and ancient lakes have provided excellent model systems for ecology, evolution, and conservation biology. I introduce examples of studies on island ecosystems that have contributed to our understanding of how biological diversity was created and how it can be maintained.

December 6
Microorganisms and environments (S. Shikano)
Nucleic acid-based methods for examining microorganisms in the environments will be lectured with comparison to classical methods that use the microscopic and culture techniques. In addition, we will talk about the microorganisms in the environments which play important roles in the element cycles.

Deeember 13
Functional ecology in plant response to environmental change (R. Oguchi)
Plants experience various environments in their life in time and space. Ecological and physiological viewpoint of plant response to the environmental change, especially about the mechanisms and restriction of adaptation and acclimation to the change in light environment will be lectured.

December 20
Biodiversity and ecosystem services (M. Aiba)
Ecosystem services are variable benefits of ecosystems to human well-being. Recent studies on relationships between biodiversity and ecosystem functions/services have demonstrated essential roles of biodiversity for provisioning of ecosystem functions/services, the stability and the multidimensionality. I explain the mechanism for the positive relationship between biodiversity and ecosystem functions/services from a perspective of plant community ecology.

Janurary 10

Regional floras and herbaria: source of information of ecological studies (K. Yonekura)

Currently biodiversity studies on land plants have been carried out throughout the World, and numerous samples (herbarium specimens, living plants and DNA samples, images, etc.) have been accumulated in research centers on each work. Based on these studies numerous floristic works have been published as a results of surveys in many levels of coverage area (nature reserve, township, region, island/s, nation, continent …), and voucher specimens of these studies are eventually kept into regional herbaria for future reference. In this lecture I introduce usefulness and how to use regional floras and herbaria as the source of information of further ecological studies. Inside tales on my compilation of regional floras (well or ill-studied area) and on my management of herbarium of Tohoku University are also included.

Janurary 17

Dendrochronology (M. Ohyama)

Dendrochronology is the science of dating tree rings. It provides the most reliable dating with the highest accuracy of any of other paleorecords, and includes investigations of the information content in the structure of dated rings and applications to environmental and historical questions. I explain its principles, methods, and applications for archaeology, ecology and paleoclimatology.

January 24

Endosymbiosis and the origin of plants (S. Maruyama)

Endosymbiosis has been a driving force of the evolution and diversification of ecosystems. In this lecture we overview the following topics and recent progress in our understanding of how photosynthetic life forms have originated and evolved.

(1) Endosymbiotic models for the evolution of the eukaryotic cells
(2) Primary and secondary endosymbioses giving rise to photosynthetic organelles
(3) ‘Solar-powered’ animals harboring endosymbiotic algae

Course Title	Elementary Particle Physics
Semester	Fall
Credit	2
Instructor	Fumihiko Suekane
E-mail	suekane@awa.tohoku.ac.jp
Class Hours / Period	Wednesday, 13:00~14:30, Oct. 5, 2016 - Jan. 25 2017
Room	Science Complex B 743

Course Objectives

The purpose of the elementary particle physics is to study building blocks of our world and to understand us through their functions. In this lecture, elementary particles and their interactions, as well as how they were observed by various experiments, will be explained by putting emphasis on their phenomenological aspects. Various quantum mechanical effects emerge purely in particle interactions. Viewing such effects intimately should be useful also to students from other science courses.

Course Summary

How elementary paricles are produced and detected are described.

Leptons, quarks and their electromagnetic, strong and weak interactions, strucute of hadrons and effects of gauge bosons will be explained. P,C, CP symmetry and their violations are introduced. Finally we will reach to the standard model.

Learning Goals

The goal of the lecture is to obtain basic knowledge of the elementary particles and their interactions and to learn how we have come to the current understandings.

A special lecture is prepared in the first day to understand the radioactivity of Sendai now.

Course Schedule	
Oct.5	The course orientation and a special lecture on "The Fukushima Saiichi accident and understanding of radio activities now in Sendai now".
Oct.12	Rutherford Scattering and Concepts for Experiments.
Oct.19	Accelerators and Particle Detectors -I
Oct. 26	Accelerators and Particle Detectors -II
Nov.2	Accelerators and Particle Detectors -III
Nov.9	Elementary Particles and their Interactions -I
Nov.16	Elementary Particles and their Interactions -II
Nov.30	Elementary Particles and their Interactions -III
Dec.7	Quark model of Hadrons and Oscillation of Neutral Kaon -I
Dec.14	Quark model of Hadrons and Oscillation of Neutral Kaon -II
Dec.21,	Symmetries, P, C, and CP violations. -I
Jan.11	Symmetries, P, C, and CP violations. -II
Jan.18	Neutrinos
Jan.25	The standard model
Course Grading	
Class participations and two homework achievements.	
Textbook	
To be specified in the lecture.	

Course Title	Solid-State Spectroscopy
Semester	2016 Fall
Credit	2
Instructor	Go Yusa
E-mail	yusa@m.tohoku.ac.jp
Class Hours / Period	10:30-12:00 Thursday
Room	Aobayama Campus　Sci.Complex B Building H03-745

Course Objectives

The field of spectroscopy has been established through the study of visible light and has over time expanded to include the electromagnetic spectrum from radio frequency waves to gamma radiation. It is now a far-reaching analytical tool particularly in material science. In this course, you will be imparted broad and basic knowledge of spectroscopy of solids as an experimental technique.

Course Summary

1. Fundamentals, electromagnetic radiation
2. Optical responses, dielectric response function
3. Light sources and detection, lasers and detectors
4. Spectroscopy in visible regime (including optical properties of semiconductors)
5. Spectroscopy in infrared regime (Raman spectroscopy, infrared absorption, and Fourier tra nsform
   infrared spectrometer)
6. Magnetic resonance spectroscopy (including nuclear spin dynamics)
7. Other spectroscopy and microscopy

Learning Goals

You will learn a basic knowledge of solid-state spectroscopy as an experimental technique through the topics above.

Course Grading

Exams

Textbook

The relevant literature will be introduced.

Course Title	Quantum Field Theory
Semester	2016 Fall
Credit	2
Instructor	Prof. Yukinari Sumino
E-mail	sumino@tuhep.phys.tohoku.ac.jp
Class Hours / Period	Friday, 13:00-14:30 October 7, 2016 – January 27, 2017
Room	Science Complex B 743

Course Objectives

The quantum field theory is important not only in the particle and nuclear physics but also in the condensed matter physics. In this lecture, after short review of quantum mechanics, the basic concepts of the quantum field theory, which are applicable to both particle theory and condensed matter theory, are described. The canonical approach to the quantum field theory is explained. After performing the quantization of various fields, the basic formulation of the perturbation theory is shown. The structure of the quantum electrodynamics and gauge theory is also mentioned.

Course Summary

Brief review of quantum mechanics
Overview of quantum field theory.
Canonical formulation of the field theory and symmetry
Canonical quantization of the scalar field
Dirac field and fermion
Interaction of fields and S-matrix
Quantum electrodynamics and gauge theory

Learning Goals

To understand the theoretical structure of the quantum field theory and to learn the techniques for calculating simple examples of the physical processes such as scattering amplitude.

Course Schedule	
10.7	Introduction, Second quantization in quantum mechanics: Boson field
10.14	Second quantization in quantum mechanics: Fermion field
10.21	Equivalence with first quantization
10.28	Relativistic field theory
11.4	Canonical quantization of scalar field
11.11	Observables
11.18	Canonical quantization of fermion field
11.25	Quantization of electromagnetic field
12.2	Quantum electrodynamics
12.9	Time evolution in interaction picture
12.16	Dyson expansion and Wick thoerem
1.6	Feynman rule
1.13	Basic perturbative calculation 1
1.20	Basic perturbative calculation 2
1.27	Renormalization
Course Grading	
Report	
Textbook	
Not specified	

Course Title	Agricultural Sciences ”Challenge to new bioindustry creation from agricultural science in Japan”
Semester	2016 fall
Credit	2
Instructors	Professor Keietsu Abe Professor Tomoyuki Fujii Professor Tadao Saito Associate Professor Tsuyoshi Tsuzuki Professor Michio Komai Professor Emiko Igarashi Professor Kiyotaka Nakagawa Professor Mari Yotsu-Yamashita Professor Shigefumi Kuwahara Professor Tohru Suzuki Professor Katsuya Gomi Associate Professor Masamichi Nakajima
E-mail	kabe@niche.tohoku.ac.jp atom@bios.tohoku.ac.jp tsaito@bios.tohoku.ac.jp tsudukit@m.tohoku.ac.jp mkomai@m.tohoku.ac.jp emiko@bios.tohoku.ac.jp nkgw@m.tohoku.ac.jp myama@biochem.tohoku.ac.jp skuwahar@biochem.tohoku.ac.jp suzukitr@bios.tohoku.ac.jp gomi@biochem.tohoku.ac.jp mnkjm@bios.tohoku.ac.jp
Class Hours / Period	Tuseday 8:50-10:20 / Oct 4, 2016 – Dec. 20, 2016
Room	Kawauchi-kita Campus, Lecture Rooms A402

Course Objectives

This course is opened in Autumn semester for understanding recent progress in bioscience and biotechnology fields and of their feasibility to create new bioindustries in Japan.

The course objective is educating students to to learn recent progress in biotechnology areas such as applied microbiology, food science, bioorganic chemistry and genomics.

Course Summary

Recent social demands for new bioindustry creation have been increasing rapidly in Japan. This course will give you basic understanding of recent progress in bioscience and biotechnology fields and of their feasibility to create new bioindustries in Japan. Leading researchers will perform lectures in biotechnology areas, especially applied microbiology, food science, bioorganic chemistry and genomics. Students are expected to join the discussion in the class. The evaluation will be based on the attendance to the lessons, contribution to discussion and reports.

Learning Goals

Students will come to understand recent pregresses of key technologies for each biotechnology area.

Course Schedule	
Oct 4	1. Solute transporters in membrane and energy generation systems in bacteria
Oct 11	2. High-Pressure Processed Foods
Oct 18	3. New functional yogurts by using probiotic lactic acid bacteria (LAB) in Japan
Oct 25	4. Bioactive components with anti-cancer and anti-angiogenesis effects
Nov 1	5. Important contribution of agricultural products and nutrients to keep our healthy life
Nov 8	6. Zoonosis
Nov 15	7. Physiological significances of food and bioactive natural products
Nov 22	8. Chemistry and biochemistry of marine natural products
Nov 29	9. Synthetic studies on insect pheromones and their utilization as eco-friendly agrochemicals
Dec 6	10. Early development of fish
Dec 13	11. Regulatory mechanism for amylolytic gene expression in a *koji*-mold, *Aspergillus oryzae*
Dec 20	12. Genetic conservation and sustainable use of aquatic organisms
Course Grading	
Students will be evaluated based on: class attendance and reports (choose two topics from 12 lectures)	
Textbook	

Subject	Introduction to Fisheries Science （水産科学概論）	Day/Period	Fri./2nd	Object	AMB/JYPE
Instructor (Post)	Yoshihiro OCHIAI, et al. (Prof.)	Categories	Specialized Subjects	Preferable Participants	2nd-year&JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	4
Subject Numbering	ABS-APS255E			Language Used in Course	English

1. Class subject

Introduction to Fisheries Science

2. Object and summary of class

This course provides an overview of the fishery science. Students will learn the fishery science on the basis of marine biology in a broad sense from molecules to ecosystems.

3. Keywords

Fisheries science, basics & outlines

4. Goal of study

The goal is to understand the fishery science basically from ecology, physiology, genetics, molecular biology and evolution, and to appreciate the fishery science as the applied marine biology.

5. Contents and progress schedule of class

Topics on marine ecology and oceanography

Lab Fisheries Biology & Ecology

Oct. 1 (Sat) -- “How to know the fish age” (S. Katayama)

Oct. 21 ---- “How to know the fish migration” (S. Katayama)

Lab Marine Plant Ecology

Sept. 23 ------ “The ecology of floating seaweeds” (M. Aoki)

Oct. 7 ---- “Introduction to rocky subtidal communities” (Y. Agatsuma)

Lab Biological Oceanography

Dec. 3 (Sat) ---- “Physical and chemical environment of marine organisms“ (Y. Endo)

Oct. 14 ---- “Plankton and benthos in the ocean” (W. Sato-Okoshi)

Topics on biology and biochemistry of aquatic organisms

Lab Aquacultural Biology

Nov. 4 ---- “Manipulation of reproduction in bivalve mollusks” (M. Osada)

Nov. 11 ---- “Immunity in marine invertebrates” (K. Takahashi)

Lab Marine Biochemistry

Nov. 25 ----- “Function of marine lipids” (T. Yamaguchi)

Dec. 2 ------ “Food chemistry of fish and shellfish” (Y. Ochiai)

Topics on fish genetics and biotechnology

Lab Marine Life Science & Genetics

Nov. 18 ----- “Fish development and biotechnology“ (T. Suzuki)

Dec. 17 (Sat) -- “Genetic conservation and sustainable use of resources in aquatic organisms“ (M. Nakajima)

Lab Integrative Aquatic Biology

Dec. 9 ------ “Conservation genetics for fishery resources -1” (M. Ikeda)

Dec. 16 ---- “Conservation genetics for fishery resources -2” (A. Kijima)

6. Preparation Refer to the recent topics in each field.
7. Record end evaluation method Attendance and report. The report should be directly submitted to the instructor of each lecture by the next lecture.
8. Textbook and references No textbook. Reference books will be introduced.
9. Self study Summarize the content of each class promptly.
10. In addition Questions, comments, and requests accepted. Send them to the representative instructor, Prof. Ochiai: yochiai@tohoku.ac.jp

Subject	Aquatic Plant Ecology (水圏植物生態学)	Day/Period	Tues./2nd	Object	AMB/JYPE
Instructor	Y. Agatsuma	Categories	Specialized Subjects	Preferable Participants	3rd-year&JYPE students
Position	Faculty of Agriculture (Graduate School of Agricultural Science)			Credits	2
				Semester	6
Subject Numbering	ABS-APS343E			Language Used in Course	English

1. Class subject
Interaction between herbivores and marine plants in coastal rocky bottoms

2. Object and summary of class
This course provides reproduction, grazing activity, population dynamics of herbivores associated with marine forest. Students will learn marine forestation, and management and enhancement means of sea urchin and abalone associated with their ecological characteristics.

3. Keywords
Kelp forest, Sea urchin, Barren, Grazing, Population dynamics, Production, Rocky subtidal ecosystem, Global warming

4. Goal of study
The goal is to understand how sea urchin and abalone maintain their population associated with seaweeds beds and how enhancement means of seaweed, sea urchin and abalone were developed on the basis of biological and ecological knowledge.

5. Contents and progress schedule of class

1. Structure and function of marine forest（Sep. 13, 20）
2. Reproduction of herbivore (Sep.24)
3. Growth and gonad production of herbivore (Sep. 27)
4. Grazing activity (Oct. 4, 11)
5. Chemical defense of seaweeds (Oct. 18)
6. Mechanisms of population maintenance and fluctuation (Oct. 25)
7. Effects of sea urchin grazing on rocky subtidal communities (Nov. 1, 8)
8. Restoration of “barren” (Nov. 15)
9. Effect of ocean warming and acidification on rocky subtidal communities (Nov. 22, 29)
10. Development of enhancement means of sea urchin and abalone (Dec. 6, 13)

6. Preparation

7. Record end evaluation method
Examination, report and attendance

8. Textbook and references
Reference texts:
Lawrence JM (2013) Sea urchins: biology and ecology. Elsevier.
Schiel DR and Foster MS (2015) The biology and ecology of giant kelp forests. University of Calfornia Press

9. Self study
Review is required.

10. In addition
Questions, comments, and requests are accepted. Send them to Professor Agatsuma: agatsuma@bios.tohoku.ac.jp
Office hour: Tuesday 16:00~18:00 in Professor room of Laboratory of Marine Plant Ecology

Course Title	Mechanics of Materials
Semester	Fall
Credit	2
Instructor	Professor Hideo Miura, Assoc. Professor Kazuhisa Sato., Assoc. Professor Go Yamamoto
E-mail	hmiura@rift.mech.tohoku.ac.jp, kazuhisa@rift.mech.tohoku.ac.jp, yamamoto@plum.mech.tohoku.ac.jp
Time and Day	Wendsdey, 8:50-10:20 (This course will start on Oct. 5, 2016.)
Place	Lecture Room-R115 International Exchange Building

Course Objectives and Outline

Mechanics of materials is a branch of applied mechanics that deals with the basic behavior of solid bodies subjected to various types of loading. The knowledge of the stress and strain set up within the bodies and resulting deflection is a prerequisite for the structural design of industrial products and infrastructures such as buildings, roads, and bridges.

This course is intended as an introductory course in the mechanics of solids offered to engineering students. It concentrates on developing analysis techniques from principle for a range of practical problems that include simple structures, pressure vessels, beams and shafts. This course is one semester course.

Learning Goal

Students will come to understand how to evaluate two-dimensinal stress and strain fields in a solid structure quantitatively.

Course Content

The topics covered in this course are Hooke's law, and stress-strain diagram, strength and stiffness, tension, compression and shear, combined stresses, torsion, shearing force and bending moment in a beam, stress and deflection of a beam, and statically indeterminate beam.

Oct. 5	Prof. Miura	Introduction (1): Modeling of engineering systems and concepts of stress and strain
Oct. 12	Prof. Miura	Introduction (2): Hooke's law, and stress-strain diagram, strength and stiffness
Oct. 19	Prof. Miura	Tension, compression and shear (1): Pin-jointed structures and statically indeterminate problems
Oct. 26	Prof. Miura	Tension, compression and shear (2): Thermal stress and residual stresses, thin rings, and stress concentration
Nov. 2	Prof. Miura	Mid-term examination (1)
Nov. 9	Assoc. Prof. Sato	Combined stresses (1): Biaxial tension, normal stress and shear stress, plane stress
Nov. 16	Assoc. Prof. Sato	Combined stress (2): Stress-strain relations
Nov. 30	Assoc. Prof. Sato	Torsion (1): Torsion of circular shafts, and close-coiled helical spring
Dec. 7	Assoc. Prof. Sato	Torsion (2): Shaft of rectangular or profile section and thin-walled tube of arbitrary cross section
Dec. 14	Assoc. Prof. Sato	Mid-term examination (2)
Dec. 21	Assoc. Prof. Yamamoto	Shearing force and bending moment in a beam: Type of supports for beams and reactions, type of loads on a beam
Jan. 11	Assoc. Prof. Yamamoto	Stress in a beam
Jan. 18	Assoc. Prof. Yamamoto	Deflection of a beam
Jan. 25	Assoc. Prof. Yamamoto	Statically indeterminate beam
Feb. 1	Assoc. Prof. Yamamoto	Final examination

Assessment Criteria
Grades of the course will be assigned as follows: AA…… Excellent (90-100%) A……. Good (80-89%) B……. Fair (70-79%) C……. Passing (60-69%) D…….Failure (0-59%)
The student's performance will be evaluated by considering the results of homework and examinations.
Textbook
1) S. Timoshenko and D. H. Young, "Elements of Strength of Materials," Van Nostrand Reinhold Company (1968). 2) W., Nash and M., Potter, "Strength of Materials, 5th Edition", McGrawhill, (2011).
Note
After the presentation of the underlying theory for each topic, the students will be provided with problems for homework to aid the understanding of the principles. It is assumed that the students have some experience in elementary statics (mechanics of rigid bodies) and mathematics (such as differentiation and integration).

Materials Science and Engineering A

Prof. Yutaka WATANABE

Contact address yutaka.watanabe@qse.tohoku.ac.jp.

PLACE: Aobayama Campus
(Department of Mechanical and Aerospace Engineering, Building 2, Room 213)

TIME: 8:50-10:20, Thursday

This course will provide concise introduction to the microstructures and processing of materials and how these are related to the properties of engineering materials. In this course, although we mostly deal with metals, properties of other engineering materials will also be discussed.

The goal of this course is understanding basic properties of materials, of how properties are related to microstructures, of how microstructures are controlled by processing, and of how materials are formed and joined.

Evaluation will be based on "class participation and homework assignment (30%)" and "final exam (70%)".

1. **Orientation** October 13 (Thursday)

2. **Properties and Structures of Metals** October 20 (Thursday)

    ・Generic metals and alloys

    ・Design data

3. **Properties and Structures of Metals** October 27 (Thursday)

    ・Range of metal structures that can be altered to get different properties

4. **Equilibrium Constitution and Phase Diagrams** November 10 (Thursday)

    ・Mixing elements to make an alloy can change their structure

5. **Case Studies in Phase Diagrams** November 17 (Thursday)

    ・Phase diagrams

6. **Case Studies in Phase Diagrams** November 24 (Thursday)

- Examples; choosing soft solders, pure silicon for microchips, making bubble-free ice

7. **Driving Force for Structural Change** December 1 (Thursday)

- Solidification, solid-state phase changes, precipitate coarsening, grain growth, recrystallization

8. **Kinetics of Structural Change** December 8 (Thursday)

- Diffusive transformations

9. **Kinetics of Structural Change** December 15 (Thursday)

- Nucleation
- Displacive transformations

10. **Case Studies in Phase Transformation** December 22 (Thursday)

- Artificial rain-making
- Fine-grained castings

11. **Case Studies in Phase Transformation** January 5 (Thursday)

- single crystals for semiconductors
- Amorphous metals

12. **Carbon Steels** January 12 (Thursday)

- Structures produced by diffusive changes
- Structures produced by displacive changes (martensite)
- TTT diagram

13. **Alloy Steels** January 19 (Thursday)

- Solution strengthening
- Precipitation strengthening
- Corrosion resistance

14. **Production, Forming, and Joining** January 26 (Thursday)

・Casting

・Plastic working

・Joining

・Surface engineering

15. **Course Summary and Exam** February 2 (Thursday)

Textbook:

Engineering Materials 2, M.F. Ashby and D.R.H. Jones, ELSEVIER

Course Title	Mechanical Vibrations I
Semester	Fall
Credit	2
Instructor	Associate Professor Hisashi NAKAMURA
E-mail	nakamura@edyn.ifs.tohoku.ac.jp
Class Hours / Period	14:40-16:10, Thursday
Room	Lecture House of the Department of Mechanical and Aerospace Engineering, Room 3 (Ki-3)

Course Objectives

To acquire fundamental knowledge regarding dynamic problems which may arise in machinery.

Course Summary

To learn dynamic characteristics of the systems with one, two and multi degrees of freedom obtained by modeling machinery.

Learning Goals

To acquire the ability to apply the knowledge obtained in this class to engineering design.

Course Schedule	
Oct. 6	1. Introduction and fundamental mathematics
Oct. 13	2. Free vibrations of one-degree-of-freedom systems (I)
Oct. 20	3. Free vibrations of one-degree-of-freedom systems (II)
Oct. 27	4. Free vibrations of one-degree-of-freedom systems (III)
Nov. 10	5. Forced vibrations of one-degree-of-freedom systems
Nov. 17	6. Free vibrations of one-degree-of-freedom systems with viscous damping (I)
Nov. 24	7. Free vibrations of one-degree-of-freedom systems with viscous damping (II)
Dec. 1	8. Free vibrations of one-degree-of-freedom systems with viscous damping (III)
Dec. 8	9. Forced vibrations of one-degree-of-freedom systems with viscous damping
Dec. 15	10. Free vibrations of two-degree-of-freedom systems (I)
Dec. 22	11. Free vibrations of two-degree-of-freedom systems (II)
Jan. 12	12. Forced vibrations of two-degree-of-freedom systems
Jan. 19	13. Vibrations of multi-degree-of-freedom systems
Jan. 26	14. Summary
Feb. 2	15. Summary and examination
Course Grading	
50%: mini test 50%: final examination Mini test will be given in the beginning of class. The coverage of mini test is contents of the previous class.	
Textbooks	
1. “Mechanical Vibrations SI (5th Edition)” S.S. Rao, Pearson Education, 2011 2. “Mechanical Vibrations” S.G. Kelly, Schaum’s Outline Series, 1996 3. “An Introduction to Mechanical Vibrations, (3rd Edition)” R.F. Steidel, Jr., Wiley, 1989	

Course Title	Electricity and Magnetism A
Semester	Fall
Credit	2
Instructor	Professor Taiichi Otsuji, Professor Takumi Fujiwara
E-mail	otsuji@riec.tohoku.ac.jp Fujiwara@laser.apph.tohoku.ac.jp
Class Hours / Period	Wednesday, 8:50-10:20, from Oct. 5, 2016 till Feb. 1, 2017.
Room	Lecture Room 2-413 (2F Seminar RM, EE_BLDG#2) Department of Electrical Engineering, Communications Engineering, Electronic Engineering, and Applied Physics, Aobayama Campus.

Course Objectives

Electricity and Magnetism (EM) is a branch of physics and one of the fundamental and key studies in the engineering. Do you know what kind of phenomena or applications are related to the electricity and magnetism? Coulomb's law, Faraday's law, and electromagnetic induction are well known in the world of physics. For applications and / or device fabrications related to the electrons and magnetism, you must study following subjects in near future; such as microwaves, antennas, plasma, fiber optics, electromagnetic interference, electromechanical energy conversion, radar meteorology, remote sensing, permanent magnet, transformers, electric relays, radio / TV, telephone, electric motors, transmission lines, waveguides, radar, laser, etc.

Course Summary

The basis of EM is the knowledge of electrons in free space and substances. Important points are following. Electrons behave as particles $(m:9.1\times10^{-31}kg, e:1.6\times10^{-19}C)$ and waves with characteristic kinetic energy and wave numbers ($\hbar^2k^2/2m$, for which $\hbar$, k are Plank's constant ($\hbar = h/2\pi$) and wave number, respectively). Electrons also possess both charges and spins. The fundamental physical properties of solids depend upon the static distributions and dynamic motions of carriers. The motions of carriers such as velocity and angular momentum are described with vectors. Therefore, the vector analysis is ***indispensable*** to understand the EM.

Learning Goals

For the first step, students are requested to obtain perfect knowledge of the laws and principles of EM, and practical skills for solving basic EM problems by choosing pertinent laws and principles of EM.

Course Schedule		
Oct. 05	Prof. T. Fujiwara	1: Introduction and outline
Oct. 12	Prof. T. Fujiwara	2: Vector Analysis 2.1: Vector Algebra
Oct. 19	Prof. T. Fujiwara	2.2: Differential Calculus
Oct. 26	Prof. T. Fujiwara	2.3: Integral Calculus -1
Nov. 2	Prof. T. Fujiwara	2.4: Integral Calculus -2
Nov. 09	Prof. T. Fujiwara	2.5: Curvilinear Coordinates
Nov. 16	Prof. T. Otsuji	3: Electro Statics 3.1: The Electric Field 3.2: Divergence and Curl (Rotation) of Electrostatic Field
Dec. 7	Prof. T. Otsuji	3.3: Electric Potential 3.4: Work and Energy in Electrostatics
Dec. 14	Prof. T. Otsuji	3.5: Conductors
Dec. 21	Prof. T. Otsuji	4: Special Techniques 4.1: Laplace's Equation
Jan. 04	Prof. T. Otsuji	4.2: The Method of Images
Jan. 11	Prof. T. Otsuji	4.3: Separation of Variables
Jan. 18	Prof. T. Fujiwara	5: Magneto Statics 5.1: The Biot-Savart Law
Jan. 25	Prof. T. Fujiwara	5.2: Applications of Ampere's Law (5.3.3)
Feb. 01	6: Final Exam.	
Course Grading		
Grades of the course will be assigned as follows: AA…… Excellent (90-100%) A……. Good (80-89%) B……. Fair (70-79%) C……. Passing (60-69%) D…….Failure (0-59%) Students will be evaluated based on: class attendance, presentations, in-class participation, homework assignments, reports and the final exam.		
Textbook		
None, print+handout		

Course Title	Introductory Quantum Mechanics
Semester	Fall
Credit	2
Instructor	Associate Prof. Simon J. GREAVES
E-mail	simon@riec.tohoku.ac.jp
Class Hours / Period	Fridays 1 pm - 2:30 pm The first class is on Friday the 7th of October.
Room	Room 2C, Electrical, Information and Physics Engineering Building No. 1

Course Objectives

To understand the differences between quantum mechanics and classical mechanics.

To develop an understanding of key quantum mechanical concepts, such as the wavefunction, Heisenberg's uncertainty principle, the Schrödinger equation etc.

Course Summary

Beginning with a review of some early 20th century experiments, this course aims to develop an understanding of the basic concepts of quantum mechanics and how they differ from classical mechanics. The Schrödinger equation will be used to solve one-dimensional problems and to show that quantum mechanics can be used to predict the existence of physical phenomena such as quantum mechanical tunneling, discrete energy levels and energy band-gaps in solids. Students are assumed to have introductory college-level physics, calculus, and linear algebra.

Learning Goals

After completing this course students should be able to use the Schrödinger equation to solve simple one dimensional problems that can be related to observed physical phenomena that cannot be explained using classical mechanics.

Course Schedule	
Oct. 7	1. Introduction. What is quantum mechanics and how does it differ from classical mechanics? Double slit experiments are used to illustrate the differences.
Oct. 14	2. Blackbody radiation. How can we explain the distribution of light emitted by black bodies, such as the sun? Photoelectric effect: the energy carried by a photon can be converted into electrical current. This is the basis of solar cell operation.
Oct. 21	3. Compton scattering. When a photon interacts with an electron we can treat the problem using relativistic mechanics. Franck and Hertz experiment: electron energy levels in gases can be determined using this simple experiment.
Nov. 11	4. Bohr's model of the hydrogen atom. A simple model is used to calculate the energy levels of the electron in a hydrogen atom. de Broglie theory: all matter has a wavelength that can be calculated using the de Broglie theory. The Davisson-Germer experiment is used to demonstrate the validity of de Broglie's theory.
Nov. 18	5. Schrödinger equation. the Schrödinger equation is introduced in its time dependent and time independent forms. Wavefunctions are solutions to the Schrödinger equation. We look at how to normalise wavefunctions and learn about the Born interpretation of the wavefunction.
Nov. 25	6. Operators and eigenvalue equations. The Schrödinger equation is an eigenvalue equation for energy. Using appropriate operators we can derive similar eigenvalue equations for momentum and other physical observables. Expectation values: given an ensemble of particles in the same initial state the expectation value is the average value of a particular property, e.g. position, momentum, energy etc.
Dec. 2	7. The infinite potential well. A simple one-dimensional problem of a particle trapped in an infinitely deep well is solved using the Schrödinger equation.

Dec. 9	8. Pauli exclusion principle, particle in a box, Heisenberg uncertainty principle. The Pauli exclusion principle requires that all particles have different wavefunctions. If many particles are placed in a box the Pauli exclusion principle leads to a "degeneracy pressure" that resists compression of the box. The Heisenberg uncertainty principle tells us that the more accurately we try to measure the position of an object, the less we know about its momentum, and vice-versa.
Dec. 16	9. Delta-function potential, scattering and tunneling. Quantum mechanical tunneling is used in many devices but cannot be explained by classical mechanics. Using a delta-function potential the Schrödinger equation is solved to show that quantum mechanics can predict this effect. Some applications of quantum mechanical tunneling are reviewed.
Jan. 6	10. One dimensional barrier problems. The Schrödinger equation is solved for various one dimensional problems, e.g. finite barrier, finite well, step potential.
Jan. 13	11. Solids, band gaps, angular momentum. The Schrödinger equation is applied to a 1D periodic potential, which is used to represent atomic nuclei in a solid. The solution demonstrates that the periodic potential leads to the creation of energy bands and band gaps.
Jan. 20	12. The harmonic oscillator. The harmonic oscillator is used to represent the vibration of atomic nuclei in solids. The solution shows that the atoms can only take certain energies and that their energy is not zero, even at a temperature of absolute zero.

Jan. 27	13. Free particles and wave packets. Solving the Schrödinger equation for a Gaussian wave packet shows that the width of the packet will increase and the amplitude decrease as it propagates.
Feb. 3	Final exam.
Course Grading	
Course grades are based on homework, mid-term and final examinations.	
Textbook	
The lecture notes, homework and class schedule can be found on the web page http://www.kiroku.riec.tohoku.ac.jp/simon/quantum	

Course Title	Basic Computer Science
Semester	Fall
Credit	2
Instructor	Assoc. Prof. Takehiro Ito, Assoc. Prof. Naoaki Okazaki, Assoc. Prof. Hiroki Nishiyama, Assoc. Prof. Takeshi Obayashi
E-mail	takehiro@ecei.tohoku.ac.jp, okazaki@ecei.tohoku.ac.jp, bcs2016@it.is.tohoku.ac.jp, obayashi@ecei.tohoku.ac.jp
Time and Day	Friday, 14:40-16:10 Starting on October. 7.
Place	Lecture Room 2A, Electrical, Information and Physics Engineering Building No.1, Aobayama Campus.

Course Objectives and Outline

This course provides a quick overview of four research fields of computer science to bridge fundamental theories of computer science with the cutting-edge research in our department. The course consists of four parts (given by four instructors): communication network, natural language processing, bioinformatics, and algorithm theory.

Learning Goal

Students will come to understand the association between the fundamental knowledge about computer science and the research activities. The emphasis will be on giving a broad overview of the research areas in computer science.

Course Content

Refer to the course schedule.

Oct. 7	Okazaki	1. Introduction to Natural Language Processing
Oct. 14	Okazaki	2. Classification 1 Perceptron
Oct. 21	Okazaki	3. Classification 2 Logistic regression
Nov. 4	Nishiyama	4. Basic Technologies for Communication Networks
Nov. 11	Nishiyama	5. Next Generation Networks 1
Nov. 18	Nishiyama	6. Next Generation Networks 2
Nov. 25	Obayashi	7. Computational Biology 1 Encode and decode biosystems
Dec. 9	Obayashi	8. Computational Biology 2 Gene network
Dec. 16	Obayashi	9. Computational Biology 3 Genetic diversity and adaptive evolution
Jan. 6	Ito	10. Algorithm Theory 1 What is algorithm? Power of “efficient” algorithms
Jan. 13	Ito	11. Algorithm Theory 2 How to evaluate algorithms
Jan. 20	Ito	12. Algorithm Theory 3 Basic techniques for algorithms

Assessment Criteria
Grades of the course will be assigned as follows: AA……..Excellent (90-100%) A……. Good (80-89%) B……. Fair (70-79%) C……. Passing (60-69%) D…….Failure (0-59%)
Attendance and writing assignments. Details will be announced by each instructor.
Textbook
None, print+handout