JYPE 2015-2016
Spring Semester
Course Description

Tohoku University
Institute for Excellence in Higher Education

Contents

Japanese 1

Instructor: Professor Satoshi Uehara and staffs

Offices: Uehara: Rm 520, Institute for Excellence in Higher Education Building

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Contact e-mail address: uehara@he.tohoku.ac.jp

Japanese 1 is for novice learners. When you successfully complete the course, you can expect to pass Level 5 (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 I" published by 3A Network. The course grade will be based on attendance, participation and in-class quizzes (50%) and the final examination (50%).

[April 6 (Wed) Registration & Placement test]

01. APR 11 (Mon) HIRAGANA

02. APR 13 (Wed) L.1-1

...wa...desu.

03. APR 18 (Mon) L.1-2 / L.2

...wa...ja arimasen. S+*ka*?

Kore/sore/are Soodesu Sooja arimasen

After April 18, the classes will be held on every Monday and Wednesday (except a few national holidays) and each class will generally cover 1 lesson. The schedule below is subject to change.

04. APR 20 (Wed) L.3 ～ JUL 11 (Mon) L.25

L.3

Koko/soko/asoko Doko/dochira N *no* N

L.4

Ima ...ji ...fun desu　V-*masu*
masu/mashita/masen/masendeshita　*...kara...made*　N *to* N　S+*ne*

L.5

N(place) *e ikimasu*　*Doko e mo ikimasen*　N(vehicle) *de ikimasu*　*Itsu*　S+*yo*

L.6

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

L.7

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

L.8

N *wa na*-adj *desu*　N *wa i*-adj *desu*　*Totemo*　*Amari*　N *wa doodesu ka*　N1 *wa donna* N2 *desu ka*　S1 *ga* S2　*Dore*

L.9

N *ga arimasu*　N *ga wakarimasu*　N *ga sukidesu*　*Donna* N　*Yoku*　*Daitai*　*Takusan*　*Sukoshi*　*Amari*　*Zenzen*　S1 *kara* S2　*Dooshite*

L.10

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

L.11

Numbers　Quantifier(period)*ni ...kai*　Quantifier *dake*/N *dake*

L.12

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

L.13

N *ga hoshii desu*　V *masu*　V *tai desu*　N(place) *e* V *masu*-form *ni ikimasu*　*Dokoka/nanika*

L.14

verb conjugation　Verb groups　Verb *te*-form　Verb *te*-form *kudasai*　V *te*-form *imasu*　V *masu*-form *mashoo ka*　S1 *ga*, S2

L.15

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

L.16

V *te*-form, [V *te*-form], ...　V1 *te*-form *kara*, V2　N1 *wa* N2 *ga*　　adjective　*Dooyatte*　*Dono* N

L.17

V *nai*-form　V *nai*-form *kudasai*　V *nai*-form *nakereba narimasen*　V *nai*-form *nakutemo ii desu*　N *made ni*

L.18

Verb dictionary form　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 ka*　V *ta-ri*, V *ta-ri shimasu*　*i*-adj *ku narimasu*　*na*-adj/N *ni narimasu*　*Soodesu ne*

L.20

Polite style and plain style　Conversation in the plain style

L.21

plain form *to omoimasu*　S/plain form *to iimasu*　plain form *deshoo*　N1(place) *de* N2 *ga arimasu*　N(occasion) *de*

L.22

Noun modification　Noun modification by sentences

L.23

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

L.24

Kuremasu　V *te*-form *agemasu/moraimasu/kuremasu*　V *te*-form *moraimasu*　V *te*-form *kuremasu*　N(person) *ga* V　Interrogative *ga* V

L.25

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

05. JUL 13 (Wed)　EXAMINATION

Japanese 2

Instructor: Professor Satoshi Uehara and staffs

Contact e-mail address: uehara@he.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 Level 4 (N4) of the Japanese Language Proficiency Test (http://www.jlpt.jp/). The course covers all 25 Lessons of "Minna no Nihongo II" published by 3A Network. The course grade will be based on attendance, participation and in-class quizzes (50%) and the examinations (50%).

[April 6 (Wed) Registration & Placement test]

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

01. APR 11 (Mon) L.26 ～ MAY 18 (Wed) L.36

L.26

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

L.27

Potential verbs　*Miemasu*　*Kikoemasu*　*Dekimasu*　*wa/mo/shika*

L.28

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

L.29

V *te*-form *imasu*　N *ga* V *te*-form *imasu*　N *wa* V *te*-form *imasu*　V *te*-form *shimaimashita*　*Dokokani*　*Dokokade*

L.30

V *te*-form *arimasu*　N1 *ni* N2 *ga* V *te*-form *arimasu*　N2 *wa* N1 *ni* V *te*-form *arimasu*　V *te*-form *okimasu*　V *te*-form *okimasu*　*Mada* V(affirmative)

L.31

Volitional form　V volitional form *to omotte imasu*　V dictionary form *tsumori desu*　V *nai*-form *tsumori desu*　V dictionary form/N *yotee desu*　*Mada* V *te*-form *imasen*

L.32

V *ta*-form *hoo ga ii desu*　V *nai*-form *hoo ga ii desu*　*...deshoo*　*...kamoshiremasen*　*Kitto*　*Tabun*　*Moshikashitara*

L.33

Imperative and prohibitive forms　*...to yomimasu*　*...to kaite arimasu*　X *wa* Y *to yuu imi desu*　S/plain form *to itte imashita*　S/plain form *to tsutaeteitadakemasen ka*

L.34

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

L.35

Conditional form　*...to*　*...tara*　N *nara*　*...hodo ...*

L.36

...yoo ni V　*...yoo ni narimasu.*　*...yoo ni shimasu*

02. MAY 23 (Mon)　MIDTERM EXAMINATION

03. MAY 25 (Wed) L.37 ～ JUL 11 (Mon) L.50

L.37

Passive verbs　N1(person1) *wa* N2(person2) *ni* V passive　N1(person1) *wa* N2(person2) *ni* V passive　N(thing) *ga/wa* V passive　N1 *wa* N2(person) *ni yotte* V passive

L.38

V plain form *no wa/ga/o ...*　*... tokimo/tokiya/tokino/tokini*

L.39

V *te*-form, ...　V *nai*-form *nakute, ...* *i*-adj *kute*, ...　*na*-adj *de, ...*　*...node*, ...

L.40

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

L.41

N1 *ni* N2 *o yarimasu*　N1 *ni* N2 *o itadakimasu*　N *o kudasaimasu*　V *te*-form *yarimasu*　V *te*-form *itadakimasu*　V *te*-form *kudasaimasen ka*　N *ni* V

L.42

... tame ni, ...　V dictinary form *no ni ...*

L.43

V *masu*-form/*i*-adj/*na*-adj *soo desu*　V *te*-form *kimasu*

L.44

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

L.45

...baai wa, ...　*...noni, ...*

L.46

V dictionary form *tokoro desu*　V *ta*-form *tokoro desu*　V *ta*-form *tokoro desu*　V *ta*-form *bakari desu*　*...hazu desu*

L.47

plain form *soo desu* ...*yoo desu*

L.48

Causative verbs V causative *te*-form *itadakemasenka*

L.49

Keigo 1 honorific verbs *o* V *masu*-form *ni narimasu* *o* V *masu*-form *kudasai*

L.50

Keigo 2 *o* V *masu*-form *shimasu* *go* V *shimasu* polite expressions *gozaimasu* ...*de gozaimasu* *yoroshii deshoo ka*

04. JUL 13 (Wed) EXAMINATION

Japanese 3

Instructor: Professor Satoshi Uehara and staffs

Contact e-mail address: uehara@he.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 Level 3 (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:

[April 6 (Wed) Registration & Placement test]

G3a/b (Grammar):

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

S3a/b (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.

R3a/b (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- Reading Comprehension-" (revised version) published by ALC.

P3a/b (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 Satoshi Uehara and staffs

Contact e-mail address: uehara@he.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, your proficiency will be between Level 2 (N2) and Level 1 (N1) 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:

[April 6 (Wed) Registration & Placement test]

G4a (Grammar):

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

S4a (Speaking):

Learn to make speeches of information-giving, commenting and reporting by writing drafts of them first and practicing them in class. You also write on various topics such as “My favorite place in my country”, “My country and Japan”, and “My experience in Japan”. The course materials are provided by the instructor.

R4a (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.

P4a (Practice):

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

SP4 (Short Program Planning):

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.

JS4 (Japanese Songs):

In this class, students learn, and learn to sing most of, many Japanese traditional and popular songs together with Japanese students. By listening to and singing Japanese songs, and through communicating and discussing their interpretations, images and impressions of them with Japanese students, the international students will learn about the culture and points of view underlying them compared with those of their own.

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.

Japanese Culture B

Koji Shidara, Lecturer
Contact email address： kojishidara@gmail.com

Place： Room 711=小講義室２=west end of 2nd floor, lecture room building)
Applied Chemistry, Chemical Engineering and Biomolecular Engineering Complex
Aobayama Campus

Hour： 14：40-16：10 Wednesday
(Some field trips will be conducted on Saturdays)

Japanese Culture B is an exploratory course designed to help students to deepen their understanding of the culture of this nation with some emphasis placed on Tohoku Region and the impact of the 2011 earthquake and tsunami. The course comprises three basic components: discussion of certain cultural aspects of the country, reading of Japanese literature, and field trips. The three components are usually linked to one another. For example, a visit to the Sant Juan Bautista Museum in Ishinomaki—a full-scale replica of the Spanish-style galleon ship that took a Sendai mission part of the way to the Vatican in the early 17th century is moored there—should help to enhance the understanding of the meaning of the recovery effort from the 2011 earthquake and tsunami disaster. The reading of *Warm Hands*—a collection of prose poems written by the wife of a Buddhist temple priest who managed an evacuation shelter at his temple following the 2011 disaster—should help to shed light on the driving force behind the 17th century mission.

Reading assignments and weekly posting on the class site will be required in preparation for an active participation in the classroom discussion. Students come from varied cultural backgrounds and they are encouraged to express their views while respecting those of the rest of the students.

Evaluation will be based on class participation, weekly web posting, and the final paper and presentation. Students should be prepared to pay about 3,000 yen for each of the two full-day field trips to cover transportation, admission fees, etc.

Course Outline

01	April 13	Course introduction; fall semester review; an overview of Tohoku Region
02	April 20	Sendai's 17th-century mission to the Vatican

03	April 27	Reading: *Warm Hands, Surviving the 2011 Tsunami—100 Testimonies of Ishinomaki Area Survivors of the Great East Japan Earthquake*
04	May 07 (Sat.)	Field trip to Ishinomaki: observing recovery processes, visiting the *Sant Juan Bautista* (replicated 17th-century galleon ship) and the Buddhist temple Dogenin
05	May 11	Visiting Sendai City Museum: seeing exhibits related to the mission to the Vatican; meeting the curator responsible for the exhibit
06	May 18	Significance of Sendai's 17th-century mission to the Vatican
07	May 25	Manga & popular music: casual ways of expressing the Japanese mind
08	June 01	Reading: "Separate Ways"—a short story by Higuchi Ichiyo, a late 19th-century woman author
09	June 08	Preparing for the field trip to Tomiya and Iwadeyama: managing a Japanese sake brewery; recording the emotions of post-Boshin War emigrants from Miyagi to Hokkaido
10	June11 (Sat.)	Field trip to Tomiya and Iwadeyama: visiting a sake brewery and a samurai school site; meeting an artist who composed wood-block prints depicting 19th-century emigration from Miyagi to Hokkaido
11	June 15	Haiku and Senryu
12	June 22	Reading a children's story in Japanese
13	June 25 (Sat.)	Zazen meditation session at Rinnoji Temple in Kitayama (9:00-10:30 a.m.)
14	July 6	Student presentation
15	July 13	Student 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

References:

The Oxford Book of Japanese Short Stories, Theodore W. Goossen, ed., Oxford, OUP, 2002

The Samurai, Shusaku Endo, New York, New Directions Books, 1997

"Legend of the Forest:　Akira Miyawaki, 87, Plants Trees with Children (YouTube video)," Forest Seawall Association, Koji Shidara (English editor), Sendai, 2015

Japanese Culture D

—A study of Japanese culture through practice of Aikido—

Ex-professor Yutaka FUJINO on behalf of Prof. Yoshitaka KASUKBE
Contact address: yu.fujino@jcom.home.ne.jp

In this course, students learn Japanese culture through practice of Aikido, which is the same as in the course of Japanese Culture C. However, considering that the most students have already completed the introductory course of Japanese Culture C, the purpose of this course is both to polish their skills still more and to deepen the understanding of various characteristic aspects of Aikido. Students are, in addition, expected to acquire the way to control his or her body and mind through practice.

The evaluation will be based on class participation and performance at the presentation.

Reference books:

Moriteru Uesiba, "Progressive Aikido: The Essential Elements" Kodansha International, 2005.
John Stevens, "Aikido: The Way of Harmony" Random House Inc., 1983.

Class Schedule:

Every Friday from Apr. 8 through July 15 except June 24.

The following basic skills are repeatedly practiced.

1. Ikkyo (Number one pinning technique)
   Omote and ura (Forward and backward)
2. Nikyo (Number two pinning technique)
   Omote and ura
3. Sankyo (Number three pinning technique)
   Omote and ura
4. Yonkyo (Number four pinning technique)
   Omote and ura
5. Gokyo (Number five pinning technique)
   Omote and ura

6. Shiho-nage (Four-direction throw) (The first pillar of Aikido throwing technique)
7. Irimi-nage (Entering throw) (The second pillar of Aikido throwing technique)
8. Kaiten-nage (Turning throw) (The third pillar of Aikido throwing technique)
9. Kote-gasesi (Wrist turn-out throw)
10. Tenchi-nage (Heaven and earth throw)
11. Kokyu-nage (Breadth-power throw)

June 24 Special lecture will be given by Aikido Doshu (Grandmaster), Moriteru Ueshiba, the Founder's grandson and Special Lecturer of Tohoku University.

July 22 Presentation

* All classes will be given at Judo-jyo in Kawauchi gymnasium.

*A wear for Aikido, Judo or Karate is needed in practice (You can buy it for around 10,000 yen). The participants in this course can borrow an Aikido wear free. In order to borrow an Aikido wear, you will be required to sign your name on the prescribed form.

*Contents of the class schedule are subject to be modified.

Science, Technology and Industry of Japan
(Contemporary Engineering Industries in Japan)

Emeritus Prof. Yoshihito Shigeno
Office: Graduate School of International Cultural Studies, East Building #317
E-mail: yoshihito.shigeno@gmail.com Tel and Fax: 022-795-3715

Room: Lecture Room C303, Kawauchi-kita Campus
Day and Time: Friday 13:00-14:30

This course aims at providing knowledge on the distinctive features of traditional and contemporary Japanese industries. By comparing these industries, you could reconsider and more deeply understand the Japanese society from the view of science.

Course Outline

1. **April. 8 Guidance**

2. **April 15 Electric vehicle and Fuel cell vehicle I**
   The development of the electric vehicle and the fuel cell vehicle will be discussed in connection with the environmental issues. Other new technologies like a hybrid
   vehicle and a ultra-capacitors are to be discussed.

3. **April 22 Electric vehicle and Fuel cell vehicle II**

4. **May 6 Electric vehicle and Fuel cell vehicle III**

5. **May 13 Advanced steel I**
   The super steel having the possibility of the revolutionary impact to the infrastructures will be discussed

6. **May 20 Advanced steel II**
   .

7. **May 27 Super conductivity-magnet levitation train I**
   The unique technology of the high speed train levitated by the superconductivity magnet being developed in Japan will be discussed. The effect to the future traffic system will be also discussed.

8. **June 3 Super conductivity-magnet levitation train II**

9. **June 10 Katana (Japanese Sword) I**
   Traditional Japanese technology of producing Katana will be introduced and its metallurgical aspects are to be discussed.

10. **June 17 Robot (Humanoid) I**
    Human like robots (humanoid) are being studied widely in Japan. The principle of walking and running with two legs and the affect of the humanoid to the society will be discussed.

11. **June 24 Robot (Humanoid) II**

12. July 1 Robot (Humanoid) III

13. July 8 Semiconductor I

The process of the innovative invention of the "blue laser diode" will be discussed. The new –type LED (light emitted diode) created by using the nanotechnology that is developed in this university is introduced as well.

14. July 15 Semiconductor II

15. July 22 Technology and Society

The effect of the advanced technology to our society will be discussed.

Remarks

Some lecture materials are to be provided in advance of the class. VTR will be often used for better understanding of the lectures. Evaluation will be based on class participation, homework assignment and the final examination.

Reference: Engineering materials 2, M.F. Ashby and D.R.H. Jones, Pergamon Press, ISBN 0080325327

The blue laser diode, S. Nakamura, S. Pearton and G. Fasol. ,Springer, ISBN3540665056

Course Title	**Mathematics B**
Instructor	Assoc. Professor Koji HASEGAWA, Assoc. Professor Yuu HARIYA Professor Tatsuya TATE
E-mail	kojihas@math.tohoku.ac.jp, hariya@math.tohoku.ac.jp tate@math.tohoku.ac.jp
Time and Day	Thursday, 8:50-10:20 *First class: April 14th
Place	Lecture Room C302, Kawauchi-kita Campus

Course Objectives and Outline

The aim of this course is to discuss various topics on modern mathematics.

Each lecturer gives 5 lectures of each topic. Course Outline is as follows.

I. Introduction to group theory (Hasegawa)

II. Limit theorems in probability theory (Hariya)

III. Introduction to Discrete Geometric Analysis (Tate)

Course content

I. (1) The notion of groups will be given, which plays a considerable role in understanding symmetries. A group arises as we focus on transformations of a certain kind in mathematical structures.

(2)(3) In particular, permutations of solutions for algebraic equations will give interesting examples. We will follow the formula by Tartaglia and Ferrari and investigate their structure from the symmetry point of view.

(4)(5) We will see that the group theory reveals why we can solve quadratic, cubic and quartic equations in terms of square, cubic or quartic roots but cannot do that for higher order equations. It is an introductory part of the so-called Galois theory, which is known as the beginning of modern mathematics.

II. Based on measure-theoretic foundations of probability theory introduced in Mathematics A, we deal with several limit theorems in the theory.

(1) After recalling some necessary notions such as independence of random variables (r.v.'s), we formulate and prove the weak law of large numbers.

(2) We then introduce the strong law of large numbers and see how the convergence in weak sense (more precisely, in the sense of convergence in probability) can be strengthened as that in the sense of almost sure convergence.

(3) As an introduction to the theory of central limit theorems, we present their prototype, so-called de Moivre-Laplace theorem, which can be proven by elementary computations involving Stirling's formula.

(4)(5) Finally we formulate and prove the central limit theorem in its full generality; for that purpose, the notion of characteristic functions of r.v.'s and some of their properties are prepared.

III. The aim 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 perfect squared rectangles.
A perfect 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, which is a discrete analogue of well-known partial differential equation called the Poisson equation.

(1) In the first lecture, perfect 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.

Textbook

Textbooks are not assigned in advance.

Assessment Criteria

The course grades will be based on attendance and reports.

April 14	Hasegawa	1. Notion of groups
April 21	Hasegawa	2. Cubic and quartic equations (1):formula by Tartaglia and Ferrari
April 28	Hasegawa	3. Cubic and quartic equations (2):symmetry point of view
May 12	Hasegawa	4. The Galois theory: an abstract formulation
May 19	Hasegawa	5. Abel's theorem
May 26	Hariya	6. The weak law of large numbers
June 2	Hariya	7. The strong law of large numbers
June 9	Hariya	8. The de Moivre-Laplace theorem
June 16	Hariya	9. Characteristic functions
June 23	Hariya	10. The central limit theorem
June 30	Tate	11. Perfect squared rectangles and Dehn's theorem
July 7	Tate	12. Proof of Dehn's theorem
July 14	Tate	13. cohomology on graphs
July 21	Tate	14. homology on graphs and discrete Jacobian
Aug. 2	Tate	15. number of spanning trees: geometric version of matrix-tree theorem

Course Title	**Organic Chemistry**
Instructor	Associate Professor Tienan Jin
E-mail	tjin@m.tohoku.ac.jp
Time and Day	Monday, 14:40-16:10 *First class: April 11, 2016
Place	Room 105 International Exchange Building, Kawauchi Campus

Course Objectives and Outline

This course is intended to introduce basic organic chemistry. The main contents of this course include the study of nomenclature, stereochemistry, structure, reactivity, reaction mechanisms, functional groups, and introductory synthesis. Emphasis is on carbon-carbon bond formation reactions.

Learning Goal

Students will learn about the characteristic properties of functional groups, the influence of molecular structures on reaction pathways, and how to predict reaction outcomes. In addition to these skills, the students will learn the basics to solving problems in organic syntheses.

Course Content

1. Molecules
2. Mechanisms
3. Acids and bases
4. Reactions with nucleophiles
5. Reactions with electrophiles

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%)

Evaluation will be based on class participation, homework assignment, and examinations.

Textbook

Foundations of Organic Chemistry, print+handout

Organic Chemistry, John McMurry, Eighth Edition

Note

High attendance is required to keep the progress of the projects.

Notebook Computer is used for solving practices.

April 11	1. Molecule Introduction & atoms & bonding
April 18	2: Bond strengths and length & stereochemistry
April 25	3: Intermolecular attractions & solubility
May 2	4: Mechanism introduction & nucleophiles, electrophiles, radicals & Drawing mechanisms
May 9	5: Equilibria and rates
May 16	6: Acids and bases introduction & equilibrium constants
May 23	7: Solubility & reactivity of bases & acid and base strengths
May 30	8: Nucleophilic substitution of haloalkanes
June 6	9: Substitution reactions of alcohols, cyclic ethers
June 13	10: Reactions of nucleophiles with aldehydes, ketones, esters, and carboxylic acids
June 20	11: Reactions with electrophiles; addition to double bonds
June 27	12: Electrophilic substitution of benzene
July 4	13: Solve problem (Practice training)
July 11	14: Solve problem (Practice training)
July 25	15: Exam

Geophysics

Associate Professor Naoki TERADA (teradan@pat.gp.tohoku.ac.jp)
Professor Shinji TODA (toda@irides.tohoku.ac.jp)
Associate Professor Weiming SHA (sha@wind.gp.tohoku.ac.jp)

PLACE: Room 105 at International Exchange Building , Kawauchi-kita Campus
TIME: Friday 8:50-10:20

This course aims at learning the outlines of geophysics. By joining this course, students will get basic knowledge in geophysics.
The following topics, which are actively investigated at the Department of Geophysics, will be introduced. (1) Space Physics: Selected topics from solar physics, interplanetary physics, magnetospheric physics, and upper atmospheric physics for the purpose of learning basic knowledge on the electromagnetic environment of the Sun, the Earth, and planets. (2) Solid Earth Physics: Selected topics from seismology, volcanology, and plate tectonics for the purpose of learning basic knowledge on the structure and dynamics of the solid Earth. (3) Fluid Earth (atmosphere and ocean) Physics: Selected topics from meteorology, global warming, and physical climatology for the purpose of learning basic knowledge on climate change and related global environment problems.
The evaluation will be mainly based on a record of attendance, and contribution to discussions.

●Each Friday from April 8 through May 13.
Lectures on Space Physics will be given by Associate Prof. Terada.
Material for the lecture will be prepared by Associate Prof. Terada.

●Each Friday from May 20 through June 17.
Lectures on Solid Earth Physics will be given by Prof. Toda.
Material for the lecture will be prepared by Prof. Toda.

●Each Friday from June 24 through July 22.
Lecture on Fluid Earth will be given by Associate Prof. Sha.
Material for the lecture will be prepared by Associate Prof. Sha.

Molecular and Cellular Biology

Assoc. Prof. Ohashi (kohashi@biology.tohoku.ac.jp)
Student Support Section, School of Science (sci-sien@grp.tohoku.ac.jp)
Place: Room 105 at International Exchange Building, Kawauchi-kita Campus
Time: 10:30 — 12:00 every Friday

This course offers an introduction to biochemistry, genetics, cell biology, early development, and neurobiology; emphasis on the cell as the basic unit of life; its composition, functions, replication, and differentiation. For evaluation, students are required to attend the class, and must submit an essay dealing with a topic covered in one of the lectures.

01. APRIL 8 (FRI) KAZUMASA OHASHI
Cell motility and cytoskeleton

02. APRIL 15 (FRI) DAISUKE YAMAMOTO
Genetic dissection of sexual behavior

03. APRIL 22 (FRI) GAKU KUMANO
Germline cell development in animal embryos

04. MAY 6 (FRI) RYUSUKE YOKOYAMA
Molecular biology of plant

05. MAY 13 (FRI) KOJI TAMURA
Pattern formation in vertebrates

06. MAY 20 (FRI) ASAKO SUGIMOTO
Dynamic cellular behaviors in embryogenesis

07. MAY 27 (FRI) KEN-ICHRO TSUTSUI
Investigation of the brain function by neurophysiological methods

08. JUNE 3 (FRI) KENSAKU MIZUNO
Signal-transduction systems in cells

09. JUNE 10 (FRI) MASAYUKI KOGANEZAWA
Neural mechanisms of courtship behavior

10. JUNE 17 (FRI) JUNKO KYOZUKA
Pattern Formation in Plants

11. JUNE 24 (FRI) KAZUHIKO NISHITANI
Roles of cell walls in plants

12. JULY 1 (FRI) MITSUNORI FUKUDA
Membrane dynamics in cells

Evolution of the Western Pacific Island Arcs and Their Environments

Lecturers: Prof. Toshifumi Imaizumi, Prof. Hiroyuki Nagahama, Prof. Yasufumi Iryu and others
Corresponding person: Jun Muto (jun.muto.a3@tohoku.ac.jp)
PLACE: At Lecture Room 105 at International Exchange Building, Kawauchi-kita Campus
DATE & TIME: Every Tuesday 10:30-12:00

This course aims at presenting some basic concepts and knowledge of 1) plate tectonics and 2) the tectonic history of the world including Japan Islands, 3) active faults and earthquakes, 4) ocean environments and their history. Also, this class deals with 5) the effect of the Western Pacific island arcs and Japan Sea to the Asian monsoon circulation. The lectures include the problems how natural hazard and earth's environmental changes affect the living world. The students can understand multidisciplinary aspects of the Western Pacific/Northeast Asian regions through the case studies referred frequently in these lectures.

01. April 12　Muto, J. : Outline of this lecture, and Rheology of rocks and subduction zone earthquake cycles
02. April 19　Osozawa, S. : Geology and morphology of Kawauchi and Hirose river area (outside small trip)
03. April 26　Toda, S. : Earthquake triggering
04. May 10　Imaizumi, T. : Earthquakes and active faults
05. May 17　Nagahama, H. : Faulting and electro-magnetic phenomena
06. May 24　Hirano, S. : Active faults in Japan
07. May 31　Nakamori, T. : Coral reefs in Japan
08. June 07　Sakaida, K. : Monsoon circulation around Japan
09. June 14　Takashima, R : Greenhouse paleoenvironments
10. June 21　Kaiho, K. : Triggers and process of macroevolution and mass extinctions
11. June 28　Sasaki, O. : Looking back of life
12. July 05　Nishi, H. : Climate change during the past 200 Myr
13. July 12　Isoda, G.: The Great East Japan Earthquake
14. July 19　Iryu, Y. : Geology and biogeography of the Ryukyu Islands

** Handouts will be prepared for every lecture.
** The evaluation will be based on the attendance and submitted report.
Submit a report on a selected subject from the lectures until July 26.
** The contents of the program are subject to be changed.

-Detail description-

This course aims at presenting some basic concepts and information of plate tectonics and the tectonic history of the Asiatic continent and the Japanese islands, active faults and earthquakes, ocean environments and their history, and climate. The lectures include the problems how natural hazard and earth's environmental changes affect the living world and human life. Students can know the multidisciplinary aspects of the Western Pacific/Northeast Asian regions through the lectures as follows.

01. Outline of lectures and, Rheology of rocks and subduction zone earthquake cycles

A brief introduction of this program is first given. Then following topic is explained. The 2011 Tohoku-Oki earthquake (Mw 9.0) caused devastating damages to wide areas in the northeastern (Tohoku), Japan. The nation-wide network of geophysical instruments has contributed to illuminate crustal deformation occurring in the area. In the lecture, I will explain that the crustal deformation being observed currently in the northeastern Japan is a part of deformation related to subduction zone earthquake cycle shedding light to various properties of rock deformation (rheology). Through this lecture, the students will learn a role of rock rheology for crustal deformation and subduction zone earthquake cycles in the NE Japan island arc-trench system.

02. Geology and morphology of Kawauchi and Hirose river area (outside small trip)

We observe Quaternary river terraces and Pliocene marine and terrestrial strata near the university.

03. Earthquake triggering

Spatio-temporal clusters in earthquake occurrence such as aftershocks and seismic swarms are universal phenomena. In other words, earthquakes do not randomly occur, which would enable us to forecast large earthquakes. We first explore how active faults interact each other and then look into several significant cases at the 2011 M9 great Tohoku earthquake. We also learn physics of stress transfer to understand the time dependency of seismic hazard.

04. Earthquakes and active faults

The Japanese islands are a typical active continental margin where active faults are well developed. They were activated repeatedly not only in geologic times but also in the historic times to have caused serious earthquake disaster, and the active faults have a potentiality for reactivation in the future. This lecture focuses on how faults are identified as "active", how the earthquake generation is related with active faults, and how their future activities are estimated.

05. Faulting and electro-magnetic phenomena

Earthquake lights, seismoelectric currents and abnormal electromagnetic radiations before, during and after large earthquakes (faulting) have been observed for a long time. For the last decade, the concern with earthquake predictions from these phenomena has been growing. Organized observations have extended to many parts of the world. Based on numerous laboratory rock fracturing or frictional sliding tests, the mechanism of seismo-electromagnetic phenomena will be lectured.

06. Active faults in Japan

The Japanese islands are a typical active continental margin where active faults are well developed. They were activated repeatedly not only in geologic times but also in the historic times to have caused serious earthquake disaster, and the active faults have a potentiality for reactivation in the future. This lecture focuses on how faults are identified as “active”, how the earthquake generation is related with active faults, and how their future activities are estimated.

07. Coral reefs in Japan.

Carbonate skeletons of marine invertebrates and carbonate deposits are important archives of paleoceanographic and paleclimatic conditions. This lecture focuses on what paleoenvironmental information is recorded in the carbonates and how we can decipher it. The development history of the Quaternary coral reefs around the Okinawa islands will be referred as an example.

08. Monsoon circulation around Japan

Japan is colder in winter than would be expected from her latitude and summers are oppressively hot. But because of a narrow land mass and a long latitudinal range from south to north, there are relatively large regional and seasonal differences in weather. The causes and consequences of Japanese climatic characteristics will be overviewed.

09. Greenhouse paleoenvironments

The rise of industrialization has led to significant global warming during the last two centuries. Therefore understanding the ocean–climate system during past greenhouse climate modes is essential for more accurate prediction of future climate and environmental changes in the warming Earth. The Cretaceous is characterized by one of the warmest period in the Earth`s history. This lecture focuses on the paleo-environmental changes in Japan during the Cretaceous time.

10. Triggers and process of macroevolution and mass extinctions

Mass extinctions are one of the most controversial areas in contemporary science. Within the last decade research into the mass disappearance of species from the fossil record has become a prominent area of paleobiological studies, following the emergence of suggestive evidence that the sudden demise of the dinosaurs and many other groups of organisms at the Cretaceous/Tertiary boundary have had an extraterrestrial cause.

11. Looking back of life

Lagerstätten are geological fossil deposits that exhibit extraordinary fossil richness and completeness. You've heard of some lagerstätten; Ediacara, Burgess or Solnhofen. We see some of these spectacular fossil deposits represent an amazing "snapshot" in the life history.

12. Climate change during the past 200 Myr.

The Earth climate repeated two climate modes of the greenhouse and icehouse with 200-300-myr intervals. This lecture explains the characteristics of each climate mode and considers the control factors of the Earth climate.

13. The Great East Japan Earthquake

The lecture overviews the casualties and damages caused by the Great East Japan Earthquake, tsunami and nuclear accident. It also reports the ongoing process of reconstruction and discussing how the affected municipalities are planning to mitigate recurrent hazards.

14. Geology and biogeography of the Ryukyu Islands

The topic of this lecture is geology and biogeography of the Ryukyu Islands. The islands, situated to the southwest of mainland Japan, encompass several tens of islands and islets, extending for more than 1,200 km and are characterized by endemic fauna and flora. Origin and genesis of the endemic biota are reviewed from a geological viewpoint.

Subject	Food and Chemistry (食糧と化学)	Day/Period	Thur./2nd *First class: April 14th	Object	AMB/JYPE
Instructor Position	Michio KOMAI, et al. Faculty of Agriculture (Graduate School of Agricultural Science)			Place	Seminar Room 2, (Lecture House, Amamiya Campus)

Class subject: **Biochemistry and chemistry of food and bioactive natural products**

Object and summary of class: This class object is to study the basic concepts of biochemistry and chemistry of food and related bioactive natural products. More than ten Professors and Associate Professors will give the lectures weekly to introduce their specific research fields.

Goal of study: The goal of this class is to obtain the background knowledge concerning biochemistry and chemistry as well as the basic principles of food science and natural products chemistry.

Contents and progress schedule of class:

1. **Bioactive food components**
   Some bioactive food components related to human health are outlined.
2. **Novel functions of dietary vitamins and minerals and its contribution to our health**
   This lecture will focus on physiological roles of vitamins and minerals in food, and also will mention about the recent knowledge of their functions for health maintenance.
3. **Food and bioactive natural products for human health**
   This lecture will give you basic understanding of the roles of food and bioactive natural products to prevent against ageing and oxidative damages (e.g., dementia, cancers, atherosclerosis). This lecture will also address the development of food for human health.
4. **Chemistry and biochemistry of marine toxins**
   Some of the marine animals contain highly toxic compounds which could cause food intoxication. Isolation, structural determination, analytical methods and pharmacology of these compounds will be presented.
5. **Application of high pressure to food processing and terahertz spectroscopy in biological systems**
   High pressure technique is one of non-thermal processing of food. In this lecture, the quality of the pressurized food will be discussed from the viewpoint of the high pressure effect on food structure. Terahertz (THz) spectroscopy has attracted significant interest in biological systems. This lecture will give some recent examples of THz spectroscopy related to biomolecules, biomedicine, and pharmaceuticals.
6. **Protein chemistry**
   Structural aspects of proteins: Secondary structure, 3D- and quaternary organization, classification of structure, misfolded proteins (prion, Alzheimer's protein etc). Structure and function of proteins and peptides.
7. **Chemistry and biology of plant hormones**
   Plant hormones are bioactive compounds that regulate various aspects of growth and development in plants. This lecture will cover how plant hormones are made and act in plants and how they have contributed to food production.
8. **Medicinal chemistry of antibacterial and antiviral agents**
   Selected topics in anti-infective agents will be discussed with an emphasis on how organic chemistry is used in the drug development process.
9. **Synthetic and medicinal chemistry of marine natural products**
   Marine natural products that display important biological activities with remarkable potency and specificity are known to be useful for understanding/regulating biological events. This lecture will give an overview of the synthetic and medicinal chemistry of some important marine natural products.

Record and evaluation method: Attendance to the lectures 50%, reports 50%

Textbook and references: Textbook and references will be introduced by each professor.

In addition:

1. Associate Professor Tsuyoshi TSUDUKI
2. Professor Michio KOMAI, Associate Professor Hitoshi SHIRAKAWA
3. Associate Professor Kiyotaka NAKAGAWA
4. Professor Mari YAMASHITA, Associate Professor Keiichi KONOKI
5. Professor Tomoyuki FUJII, Associate Professor Masae TAKAHASHI
6. Associate Professor Tomohisa OGAWA
7. Professor Shinjiro YAMAGUCHI
8. Professor Hirokazu ARIMOTO
9. Professor Makoto SASAKI, Associate Professor Haruhiko FUWA

Subject	Introduction to Applied Animal and Dairy Science (応用動物・酪農科学概論)	Day/Period	Fri./2nd *First class: April 15th	Object	AMB/JYPE
Instructor Position	Sanggun Roh, et al. Faculty of Agriculture (Graduate School of Agricultural Science)			Place	Seminar Room 2, (Lecture House, Amamiya Campus)

1. Class subject
Introduction to Applied Animal and Dairy Science

2. Object and summary of class
This class object is to study the basic concepts of applied animal and dairy science. More than ten Professors and Associate Professors will give the lectures weekly to introduce their specific research fields.

3. Goal of study
The goal of this class is to obtain the background knowledge about animal and dairy science including comparative physiology, anatomy, nutrition, genetics, reproduction, animal product, immunology, microbiology, environment biology, and animal behavior.

4. Contents and progress schedule of class

1) Overview of Animal Reproduction
Major interest is to elucidate the physiological mechanism controlling reproduction and development in mammals and to develop biotechnology in reproduction of domestic, laboratory and endangered animals.

2) Overview of Animal Nutrition
Introduction to metabolism of protein, fat and carbohydrate; energy metabolism with emphasis on mitochondrial ATP production; metabolic regulation in response to environmental stress in farm animals.

3) Overview of Animal Breeding and Genetics
For the genetic improvement of meat production and disease resistance, several subjects are studied with statistical genetics, molecular biology, physiology and immunology based on animal breeding theory.

4) Overview of Animal Physiology
Our research area offers the new information about the basic principles of animal physiology and their applications, in order to investigate the molecular mechanism of the endocrine and metabolic systems in the ruminant.

5) Overview of Animal Cell Biology
Our research is focused on mutual relationship of the structures and functions of cells and tissues during embryogenesis, development and growth of farm animals to utilize animal production.

6) Overview of Animal Microbiology
The microbial world includes all living organisms that can perform the basic function of life-metabolism, reproduction, and adaptation-as single celled creatures. Our laboratory is interested in bacterial genetic engineering, bacterial flora and zoonotic diseases. Our goal of research and education is the production of healthy animals including humans.

7) Overview of Animal Food Science)
Topics of cell components and bioactive substances from probiotic lactic acid bacteria used in fermented milk are mainly researched with food chemical and immunological levels to advanced human and animal uses.

8) Overview of Grazing Management
Grazing systems have various functions on animal production and ecological conservation. We introduce the outline of herbivore grazing and refer to its effects on animal welfare and bio-diversity.

9) Overview of Animal Health and Management
Zoonotic microorganisms and pathogenic microorganisms in the environment of the animal production as well as functional microorganisms in animal waste treatment systems are studied.

5. Record end evaluation method: Attendance to the lectures 50%, reports 50%

6. Textbook and references: Textbook and references will be introduced by each professor.

7. In addition
1) Professor Kentaro Tanemura, Associate Professor Kenshiro Hara
2) Professor Masaaki Toyomizu
3) Associate Professor Tomokazu Fukuda
4) Associate Professor Sanggun Roh
5) Professor Hisashi Aso, Associate Professor Tomonori Nochi
6) Professor Emiko Isogai, Associate Professor Hiroshi Yoneyama
7) Professor Tadao Saito, Associate Professor Haruki Kitazawa
8) Professor Yutaka Nakai, Associate Professor Chika Tada
9) Associate Professor Shin-ichiro Ogura

Materials Science and Engineering B

Prof. Katsunari OIKAWA (k-oikawa@material.tohoku.ac.jp)
Prof. Hongmin ZHU (hzhu@material.tohoku.ac.jp)
Assoc. Prof. Takahiro MIKI (miki@material.tohoku.ac.jp)

Place: Lecture Hall, Materials Science and Engineering
Hour: 13:00-14:30 Tuesday , starting from April 12th, 2016.

"Materials Science and Engineering B" is a half year class to learn the fundamentals of the "Materials Processing" based on the high temperature physical chemistry and process engineering. This class basically consists of three parts as thermodynamics for materials processing, ferrous and process metallurgy（iron- and steel-making), nonferrous metallurgy（pyro- and hydro-metallurgy), and electro-metallurgy in active metal processing. Students can study fundamentals and latest topics in the area of materials processing and engineering. The grade of students will be evaluated with the score of home works, class participation, exercises during the class and the final examination.

Course Outline

1. Guidance
2. Introduction to chemical thermodynamics for materials processing I
3. Introduction to chemical thermodynamics for materials processing II
4. Reduction/Oxidation equilibrium for materials.
5. Stability diagrams and phase diagrams of materials.
6. Basic principle of iron and steel making.
7. Fundamentals of pyrometallurgy I
8. Fundamentals of pyrometallurgy II
9. Application of pyrometallugry（Copper making）
10. Application of pyrometallugry（Zinc, Lead production）
11. Fundamental electrochemistry in metallurgy
12. Application of hydrometallurgy
13. Aluminum and active metal production I
14. Aluminum and active metal production II
15. Final examination

Computer Software Engineering

Assoc. Professor Hideaki Goto (hgot@cc.tohoku.ac.jp)

Place: Kikai Lecture Room 1, Division of Mechanical Engineering, Aoba-yama Campus

Hour: 8:50-10:20 Tuesday, starting from April 12th, 2016.

Course Outline

This course will give students the basic knowledge about algorithms and data structures. Evaluation methods and programming techniques for making good programs will be discussed in the lecture style. Programming in a particular language is not included. Three or four assignments and the final exam will be given. The grades will come from the in-class final exam (30%) and the assignments (70%).

1. Introduction of the course, Computation and Algorithms
2. Evaluation of computational complexity
3. Data structures, Abstract Data Types (ADTs)
4. Basic data structures : array, list
5. Basic data structures : stack, queue
6. Basic data structures : graph, tree
7. Basic data structures : set, table (dictionary), hashing
8. Priority queue, heap
9. Binary search tree and Balanced search tree
10. Sorting : bubble sort, shell sort, bucket sort, radix sort, insertion sort
11. Sorting : heap sort, quick sort, merge sort
12. Graph searching : breadth-first search, depth-first search
13. Graph algorithms : minimum spanning tree, shortest path problem
14. Optimization problems
15. * Final Examination

Textbook:

Handouts will be given.

Thomas A. Standish, “Data Structures in Java," Addison-Wesley (1997) as a reference text.

Note:

1) Students have to do all the assignments and take the final exam.

2) Although high programming skill of a particular language is not required, students need to have some knowledge about a programming language, preferably C or Java.

3) The contents of this program are subject to change.

Course Title	**Fundamentals of Computer Engineering**
Instructor	Professor Hiroaki Kobayashi Graduate Scool of Information Sciences
E-mail	koba@cc.tohoku.ac.jp
Time and Day	Monday, 13:00-14:30
Place	Kikai No.5 lecture room, School of Engineering, Aobayama Campus

Course Objectives and Outline

In this course, students should be able to:
(1) know the concept of today's computers based on the history of computers development,
(2) learn data representation for computers and the mathematical foundation of computer arithmetic, and
(3) understand the concrete structure and functionality of modern computer systems through their basic components of arithmetic unit, memory and control unit as building blocks in terms of hardware and software.

Learning Goal

As the lerning goal, students have aquired the knowledge of circuit design and organization of modern computer systems.

Course Content

After the quick revew of computer systems development in the history, the course gives the mathematical foundation for computer system design. Based on the mathematical fundaton, the design methodology of basic circuits such as combinational circuits and sequential circuits is given. And then, the course describes how a computer system is constructed by using several basic combinational and sequential circuits, and discusses its functionality to carry out arithmetic and logic operations. In addition, the format of a machine language to direct operations to the computer system and its interpretation to generates control signals will be presented.

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, homework assignments, reports and the final exam.

Textbook

David A Patterson and John L. Hennessy, Computer Organization & Design: The Hardware/Software Interface, Morgan Kaufmann, November, 2011.

Course Schedule
1) April 11 Course Introduction, and History and Fundamentals of Computers
2) April 18 Number Representation: Binary Digit (Part I)
3) April 25 Number Representation: Binary Digit (Part II)
4) May 5 Boolean Algebra (Part I)
5) May 9 Boolean Algebra (Part II)
6) May 16 Combinational Logic and it Applications (Part I)
7) May 23 Combinational Logic and it Applications (Part II)
8) May 30 Sequential Logic: Basics (Part I)
9) June 6 Sequential Logic: Basics (Part II)
10) June 13 Sequential Logic: Applications (Part I)
11) June 20 Site Visit to Supercomputer Center of Tohoku University
12) June 27 Sequential Logic: Applications (Part II)
13) July 4 Organization of Computer Systems
14) July 11 Control Mechanism of Computer Systems
15) July 25 Final Examination

Course Title	**Electricity and Magnetism B**
Instructor	Professor Masahiro Yamaguchi Professor Toshihiko Hirooka
E-mail	yamaguti@ecei.tohoku.ac.jp hirooka@riec.tohoku.ac.jp
Time and Day	Friday, 8:50-10:20, starting from April 15th, 2016.
Place	Room 1－330 (Research Building No. 1, 3F, Seminor Room 330) Department of Electrical, Information and Physics Engineering, Aobayama Campus.

Course Objectives and Outline

This course E&M B is the second half of one year-long course for the foundation of the theory of electricity and magnetism; "Electricity and Magnetism A" (E&M A) and "Electricity and Magnetism B" (E&M B). Review of E&M A will be firstly lectured. Maxwell's equations are derived to introduce the propagation of the electromagnetic plane wave and the radiation of the electromagnetic wave. The electric and magnetic fields in matters, and electromagnetic induction will be also lectured.

Learning Goal

The students will understand Maxwell's equations in terms of the propagation of the electromagnetic plane wave and the radiation of the electromagnetic wave. The electric and magnetic fields in matters, and electromagnetic induction will also be mastered.

Course Content

1. Review of Electricity and Magnetism A
2. Review of Electricity and Magnetism A
3. Maxwell's equations and electromagnetic plane wave in vacuum
4. Electromagnetic plane waves in vacuum and matter
5. Reflection and transmission of plane wave at planar boundary between two media
6. Radiation of electromagnetic wave
7. Radiation of electromagnetic wave by an electric dipole
8. Electromagnetic induction (Faraday's law)
9. Dielectric materials and electric dipole moment
10. Polarization, dielectric constant and capacitors
11. Boundary conditions at two different dielectric media
12. Boundary conditions at two different magnetic media
13. Nonlinear media; ferromagnetism and magnetic circuit
14. Magnetic dipole and magnetization current
15. 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%)
Students will be evaluated based on: Problems for exercise will normally be assigned at the end of each class and solved during the next class. Homework exercise will be due the following week before the class. The course grades are basically determined by homework and the final examination.
Textbook
There is no set text. Many textbooks cover the topics in the course, some examples are: E. M. Purcell, Electricity and Magnetism (Berkeley, Volume 2), D. J. Griffiths, Introduction to Electrodynamics (2nd ed.), R. P. Feynman, The Feynman Lectures on Physics (Volume 2), J. D. Jackson, Classical Electrodynamics (2nd ed.), J. A. Edminister, Electromagnetics (2nd ed.)
Note
The students are assumed to have had introductory college-level physics and calculus including simple vector analysis. E&M A or an equivalent is a prerequisite to take E&M B.

April 15	Hirooka	1. Review of Electricity and Magnetism A, I
April 22	Hirooka	2. Review of Electricity and Magnetism A, II
May 6	Hirooka	3. Maxwell's equations and electromagnetic plane wave in vacuum
May 13	Yamaguchi	8. Electromagnetic induction (Faraday's law)
May 20	Hirooka	4. Electromagnetic plane waves in vacuum and matter
May 21	Hirooka	5. Reflection and transmission of plane wave at planar boundary between two media
May 27	-	No class (Sports day of Faculty of Engineering)
June 3	Hirooka	6. Radiation of electromagnetic wave
June 10	Yamaguchi	9. Dielectric materials and electric dipole moment
June 17	Yamaguchi	10. Polarization, dielectric constant and capacitors
June 24	-	No class (officially lecture day), backup
July 1	Yamaguchi	11. Boundary conditions at two different dielectric media
July 8	Hirooka	7. Radiation of electromagnetic wave by an electric dipole
July 15	Yamaguchi	12. Boundary conditions at two different magnetic media
July 22	Yamaguchi	13. Nonlinear media; ferromagnetism and magnetic circuit
July 29	Yamaguchi	14. Magnetic dipole and magnetization current
Aug. 5	Yamaguchi	Final Exam

Chemistry of Materials

Associate Prof. Fabio PICHIERRI Prof. Toshiaki YOSHIOKA, Prof. Keisuke ASAI, and Associate Prof. Guido GRAUSE
Contact address: fabio@che.tohoku.ac.jp (Fabio PICHIERRI)

Place: 化小（１）…No. 711 at Aobayama Campus
Time: 10:30-12:00 (Thursday)

Course Objective:

We are surrounded by a large number of chemical products manufactured with various types of materials including organic, inorganic, polymeric, and their composite materials. Also, in our body, biological materials are being formed using a variety of chemical and biochemical reactions. The present course focuses on the importance of chemistry in developing functional materials in various areas of technology. The main objective of the course is to learn how chemistry contributes to the development of novel functional materials.

Course Schedule:

Part 1. Chemistry of organic and biological materials (4/14 – 4/28)
- 1.1 Basic organic chemistry
- 1.2 Carbon nanomaterials (fullerenes, graphene, etc.)
- 1.3 Structure and properties of biopolymers

Part 2. Polymer Materials (5/12 – 5/26)
- 2.1 Polymer Fundamentals
- 2.2 Polymer Synthesis
- 2.3 Polymer Properties

Part 3. Chemistry of inorganic materials (6/2-6/16)
- 3.1 Basic inorganic chemistry
- 3.2 Transition metal oxides and zeolites
- 3.3 Coordination polymers and reticular solids

Part 4. Chemistry of composite materials (6/23 – 7/7)
- 4.1 Matrices and their Properties
- 4.2 Reinforcements and Composite Design
- 4.3 Composite Processing

Textbook: Not necessary
Grading Method: Attendance and participation.
Prerequisite: Knowledge on fundamental chemistry necessary.

Biotechnology

Instructors: Prof. Mitsuo UMETSU, Prof. Nobuyuki UOZUMI,
Prof. Shinichiro SHODA

Email: uozumi@biophy.che.tohoku.ac.jp (Prof. Uozumi)

Place: Room"Kasho",Department of Applied Chemistry, Chemical Engineering and Biomolecular Engineering, School of Engineering (Aobayama campus)
Hour: 13:00-14:30 Wednesday, starting from April 13th, 2016.

Abstract and objective:
Biotechnology refers to any technological applications of biological systems, such as enzymes, microorganisms, plant cells, and animal cells, to make or modify products or processes for specific purposes. This includes recombinant gene based and/or tissue culture based processes that have only been developed during the past three decades. This class focuses on the issue on chemical biology process, genetic engineering and biological membrane transport. Students will learn some basic aspects of biotechnology, with special emphasis on the synthesis of biochemical components, genetic engineering, biomedical engineering, membrane transport system and glycotechnology.

Course plan:
1. Introduction and principles of carbohydrate chemistry
2. Chemical glycosylation
3. Enzymatic glycosylation
4. Synthetic strategy of glycoproteins
5. Summary and test
6. Gene and protein engineering
7. Gene and protein engineering techniques
8. Topics in gene and protein engineering
9. Topics in biomaterials and biomedical engineering
10. Summary and test
11. Introduction and principles of biological membrane transport
12. Structure of membrane transport proteins
13. Function of membrane transport proteins
14. Cellular response to abiotic and biotic stress
15. Summary and test

Requirements: Knowledge of organic chemistry and biochemistry will be required.

Evaluation: Examinations and/or reports, depending on topics. No make-up exam.

Course Title	**Separation Science and Engineering**
Instructor	Professor Hiroshi Inomata, Professor Richard L. Smith, jr., Professor Takao Tsukada
E-mail	inomata@scf.che.tohoku.ac.jp, smith@scf.che.tohoku.ac.jp, tsukada@pcel.che.tohoku.ac.jp
Time and Day	Thursday, 13:00-14:30
Place	Lecture Room-Middle (Chu-Kougi sitsu, 2F, Lecture Room Building) Department of Applied Chemistry, Chemical Engineering and Biomolecular Engineering, Aobayama Campus.

Course Objectives and Outline

This course is opened in Spring semester for understanding the science and engineering of separation technology. The course objective is educating students to solve the problems arising in all chemical engineering industry related to design of separation processes, and to learn basics of chemical engineering separation processes and fundamentals for designing the equipments and operation conditions.

Learning Goal

Students will come to understand how to select a sutable separation process for each objective in engineering applications and aldo how to design separation processes such as distillation, extraction, and membrane separation. The emphasis will be on developing skills to chemical engineering fundamentals in separation processes such as material balance, and enthalpy balance.

Course Content

The application of phase equilibrium, mass balance and mass transfer theory to the design and analysis of chemical engineering separation processes. Target applications are distillation, liquid extraction, adsorption and other advanced separation processes such as chromatography, membrane and supercritical extraction.

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, in-class participation, homework assignments, reports and the final exam.

Textbook: None, print+handout

Note

High attendance is required to keep the progress of the projects.

Notebook Computer is used for solving practices.

Course Schedule	
April 14	1. Introduction & general discussion of separation processes
April 21	2:Distillation fundamentals (VLE, vapor pressure, bubble-point)
April 28	3: Batch distillation & flash distillation
May 12	4: Multi-stage distillation 1
May 19	5: Multi-stage distillation 2
May 26	6: Liquid-liquid extraction fundamentals (triangular diagrams, LLE)
June 2	7: Multistage extraction-1 （simplified）
June 9	8: Multistage extraction-2 （rigorous 1）
June 16	9: Multistage extraction-3 （rigorous 2）
June 23	10: Adsorption & chromatography : fundamentals
June 30	11: Adsorption & chromatography : applications
July 7	12: Filtration & membrane separation : fundamentals
July 14	13: Filtration & membrane separation　applications
July 21	14: Total Review (Practice Training)
July 28	15: Exam

Geological Environment and Earthquake Disaster

Professor Masato Motosaka, Assoc. Prof. Susumu Ohno
Contact address: motosaka@archi.tohoku.ac.jp

PLACE: Civil Engineering and Architecture Lecture Room 103
TIME: 8:50-10:20 on Thursday in April, May, June, and July

It is clear through past disastrous earthquakes that the earthquake damage is quite different depending on the geological conditions. The earthquake observation explains this truth. Therefore, it is important to take into account the difference of ground motion due to soil conditions in a seismic design of urban structures and in urban disaster prevention planning. This course comprises the lectures, students' presentations and discussions on engineering topics for earthquake disaster prevention considering geological environment. In each lecture, the relevant material will be handed out. In this course, two reports are requested and students make presentation based on the materials of the task during classes. The evaluation will be based on the reports and presentations for the requested subjects.

SCHEDULE:

01. April 07(Thu) Introduction to Earthquake and Building Structures
02. April 14(Thu) Recent Earthquake Damage and Lessons(I)
03. April 21(Thu) Recent Earthquake Damage and Lessons(II)

1st Report（Deadline: April 28）

04. April 28(Thu) Students' presentation on the 1st Report and Discussion
05. May 12(Thu) Measurement of Ground Motion and Structural Vibration
06. May 19(Thu) Overview of Geological Structure and Ground Motion Characteristics
07. May 26(Thu) Introduction to Wave Propagation Theory and Structural Vibration
08. June 02(Thu) Structural Health Monitoring
09. June 09(Thu) Earthquake Damage Prediction –Natural and Social Information－
10. June 16(Thu) Seismic Protection Technology –Earthquake Early Warning System－

2nd Report (Dead line: June 23)

11. June 23(Thu) Recent Topics on Earthquake Disaster Prevention Projects
12. June 30(Thu) Students' presentation on the 2nd Report and Discussion

Individual Research Training Senior Course in the Tohoku University Junior Year Program in English (JYPE)

(IRT Senior)

Applicable to undergraduate level short-term international exchange students only

Course description

The Individual Research Training Senior (IRT Senior, or IRT S) Course is an advanced course of the Individual Research Training B course in the Tohoku University Junior Year Program in English (JYPE). Though short-term international exchange students are not degree candidates at Tohoku University, a similar experience is offered by special arrangement. Students are required to submit:

(1) an abstract concerning the results of their IRT Senior project for each semester,
(2) a paper (A4, 20-30 pages) on their research at the end of the exchange term, and
(3) an oral presentation on the results of their IRT Senior project near the end of the exchange term.

While the total school hours for Individual Research Training A/B is 300 hours per semester, IRT Senior requires 550 hours per semester, as shown in the table below. Students are allowed to take the IRT Senior course if they would rather concentrate on laboratory work, and their supervisors recommend they register for "IRT Senior" to achieve satisfactory outcomes from their laboratory experience. Students are thus required to consult with their supervisors prior to course registration, and to discuss their requirements for IRT Senior and their needs for courses other than IRT Senior. The enrollment conditions for IRT Senior are follows.

1) The student has finished the necessary courses for graduation and obtained excellent grades.

2) The student's academic advisor judges the student to have sufficient ability to take and understand graduate-level classes.

3) The student has a strong desire to undergo research training (IRT).

4) The student will obtain three or more Tohoku University credits in subjects other than research training (IRT Senior), and will be able to complete the JYPE program.

Table 1: Credit units and school hours for IRT A/B and IRT Senior

Course Name		IRT A/B	IRT Senior
School hours for Individual Research Training (IRT) (hours/semester)	1. Implementation Hours (Research time)	150	300
	2. Hours of Laboratory Activity	150	250
Total School Hours (hours/semester)		300	550
Credit units of Tohoku University		5	10

Note: Numbers for school hours indicate hours per semester (15 weeks). Implementation Hours for IRT A/B and IRT Senior on average will be 2.0 and 4.0 hours per day, respectively. Credit units of Tohoku University will be awarded based on the "Implementation Hours" from the above, after successful performance as determined by the committee in charge. However, students are not required to complete a thesis. The above school hours are estimates that depend on discipline, school/department, and laboratory.

Description of school hours for IRT Senior

1. Implementation Hours

During implementation hours students work with the support of their assigned research groups (laboratory) to do individual research on current topics closely related to their majors. Students conduct experiments, calculations, theorizations and related activities, and are expected to acquire basic research-related knowledge and techniques for doing real research. To achieve IRT Senior course goals and objectives, which emphasize fundamental and high-quality research experiences, implementation hours are set at 300 hours/semester in the IRT Senior course, more than 50% of the total School hours.

2. Hours of Laboratory Activity: oral presentations, seminars, meetings, tutorials, independent studies, others

Students are assigned to laboratories with the consent of the faculty member in charge, and will be encouraged to participate in various laboratory activities. During laboratory activities, students are expected to prepare for a few **oral presentations**, which are required as compulsory activities. In the oral presentations, students are expected to show their understanding of basic theories in their major, produce solid research proposals, analyze experimental results, and then to combine ideas and laboratory research results into creative

and academically self-consistent works. Students are required to participate in a **seminar**, which is an important part of the laboratory activities, usually once a week for 90-120 minutes. Active participation and good preparation are needed to acquire comprehensive knowledge and develop the ability to think analytically and critically. **Meeting** with academic advisors is one of the most important aspects of the laboratory activities. Students can ask various questions, discuss with their advisors, and receive suggestions concerning their research projects. Sometimes, students may be given assignments by their supervisors, which will greatly enhance their research projects. Each student is supported by a tutor in the laboratory, who guides him/her a lot in research and daily life. **Tutorials** conducted as laboratory activities are opportunities for discussions and group work with the tutors and other laboratory members, during which senior students often instruct juniors. Students are encouraged to discuss the results of their research with labmates to receive feedback, while doing the same concerning the work done by others. Through tutorials, students are motivated and learn from each other, to be competent and responsible members of the laboratory. The **independent study** for laboratory activities includes completing assignments, reading relevant papers, analyzing research data and preparing for papers on research to be submitted to the supervisor at the end of the exchange term. **Other laboratory activities** allow students to interact intellectually and culturally with other students and professors, and to acquire intercultural understanding. This allows students to form life-long friendship and future close relations. The allotment of these Hours of Laboratory Activities depends on the assigned laboratory, discipline, school and/or department. Detailed information on the laboratory schedule will be provided by the professors at Tohoku University.