Mathematics Tutorial Ia (1.0credits) (数学演習１ａ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	RICHARD Serge Charles Designated Professor		

●Course Purpose

The aim of this course is to deepen the understanding of calculus and to cultivate the ability to apply mathematical knowledge.The course is mainly intended for students taking Calculus I. Students will have the opportunity to manipulate thevarious notions introduced during the lectures.

●Prerequisite Subjects

Calculus I

●Course Topics

Exercises sheets will be provided each week before the tutorial, and will be available on the web site of the course.Homework will be due every week during the tutorial. For more information:http://www.math.nagoya-u.ac.jp/richard/fall2020.html

●Textbook

Free reference books and lecture notes are available on the website of the course

●Additional Reading

Free reference books and lecture notes are available on the website of the course

●Grade Assessment

Your final grade will be determined by homework (50%) and quizzes (50%).The grading scale will be: A+: 95 - 100, A: 80 - 94, B: 70 - 79, C: 65 - 69, C: 60 - 64,F: 0 - 59.

●Notes

Some basic knowledge on calculus from high school is assumed, including differentiation and integration ofpolynomial functions.

●Contacting Faculty

Email to : richard@math.nagoya-u.ac.jp

Mathematics Tutorial Ib (1.0credits) (数学演習１ｂ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	BACHMANN Henrik Designated Associate Professor		

●Course Purpose

The aim of this course is to provide essential mathematical knowledge necessary to further study mathematics andother sciences at university level. The course is intended for students taking Linear algebra I.

●Prerequisite Subjects

The course is intended for students taking Linear algebra I.

●Course Topics

Linear systems, Gaussian elimination, matrices, vectors, linear maps, matrix multiplication, the inverse of a linear map,subspaces of Rn, image and kernel, linear independence, bases, dimension, coordinates, orthogonal bases, theGramSchmidt algorithm, QR factorization, orthogonal complement, orthogonal maps, least square approximations.

●Textbook

Otto Bretscher: Linear Algebra with Applications, fourth edition, Pearson 2009.ISBN: 978-0-13-600926-9

●Additional Reading

●Grade Assessment

The assessment of this course coincides with the assessment of the course Linear Algebra I.

●Notes

High-school level mathematics.

●Contacting Faculty

Fundamental Physics Tutorial Ia (1.0credits) (物理学基礎演習１ａ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	SHIGEMORI Masaki Designated Professor		

●Course Purpose

This is the companion course to the lecture course Fundamentals of Physics I on introductory calculus-based mechanics. It offers exercises to cultivate the ability to analyze and solve problems, as well as presentation and discussion skills so as to participate effectively in discussions among peers and instructors, leading to mastering the concepts introduced in the lecture course. Therefore students taking the lecture course are expected to register for this tutorial course.

●Prerequisite Subjects

Fundamentals of Physics I; Calculus I

●Course Topics

See syllabus for Fundamentals of Physics I

●Textbook

Students are required to purchase the online Fundamentals of Physics Extended 11th Edition International Student Version with WileyPLUS Set (John Wiley & Sons, 2018 ISBN: 978-1119460138).[However, do not purchase it before the first class meeting where further details will be announced in class]

●Additional Reading

Feynman Lectures On Physics (Vol.1) by Richard P. Feynman (Pearson PTR)

●Grade Assessment

Attendance, class participation, quizzes and assignments. Details will be explained at the first tutorial.Class attendance is required. Absentee must give a valid reason supported by documents. A student will receive an “Absent” grade if he is absent for more than 2 times without valid reason.

●Notes

Hybrid or online only (will use Zoom or Teams)Please keep Zoom and Teams upgraded to the latest version.

●Contacting Faculty

By appointment. Please email instructors to make an appoinment.

Fundamental Physics Tutorial I b (1.0credits) (物理学基礎演習１ｂ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	TAMA Florence Muriel Professor		

●Course Purpose

This is a companion course to Fundamental Physics II, and offers practical exercises for mastering the concepts introduced in the lecture courses. Students taking the lecture courses should also take this tutorial class

●Prerequisite Subjects

Concurrent registration with Fundamentals of Physics II

●Course Topics

Course ContentsSee syllabus for Fundamental Physics II.

●Textbook

Fundamentals of Physics Extended 10th Edition International Student Version with WileyPLUS Set (John Wiley & Sons, 2010 ISBN: 9781118230749)

●Additional Reading

Contact the instructor in charge.

●Grade Assessment

Weekly tutorials, quizzes (Weighting to be advised)Absent: submission of Course Withdrawal Request Form requiredFail: total accumulated score of less than 60%.

●Notes

Concurrent registration with Fundamentals of Physics IIThe class will be face-to-face or conducted remotely - information will be available on the NUCT website before class start.

●Contacting Faculty

By email: florence.tama@nagoya-u.jpQuestion to teachers should be asked using the NUCT function "Message"

Mathematics Tutorial II a (1.0credits) (数学演習２ａ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	RICHARD Serge Charles Designated Professor		

●Course Purpose
The course is mainly intended for students taking Calculus II. Students will have the opportunity to manipulate the various notions introduced during the lectures.

●Prerequisite Subjects
Calculus II, G30 program

●Course Topics
Exercises sheets will be provided each week before the tutorial, and will be available on the web site of the course. Homework will be due every week during the tutorial.

●Textbook
Free reference books and lecture notes will be available on the website of the course.

●Additional Reading
Notes provided during the lectures of Calculus II.

●Grade Assessment
The final grade will be determined by homework (50%) and quizzes (50%). The grading scale will be The grading scale will be A+, A, B, C, C-, F.Depending if the tutorial sessions are compulsory or elective, the criteria are different. Discuss with the instructor for more information.

●Notes
Some notions on functions of one variable, as seen in Calculus I. A basic knowledge of linear algebra will be an assetWebsite for this course:http://www.math.nagoya-u.ac.jp/~richard/spring2022.htmlMost probably hybrid.

●Contacting Faculty
Email to : richard@math.nagoya-u.ac.jp

Mathematics Tutorial II b (1.0credits) (数学演習２ｂ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	BACHMANN Henrik Designated Associate Professor		

●Course Purpose
The objective of this course is to provide essential mathematical knowledge necessary to further studies in mathematics and science at university level. The course is primarily intended for students taking the course Linear algebra II.

●Prerequisite Subjects
Linear Algebra II

●Course Topics
Orthogonal maps, vector spaces, determinants and their applications, eigenvalues and eigenvectors, applications of eigenvalue theory, linear differential equations.

●Textbook
do not appoint the textbook

●Additional Reading
Otto Bretscher: Linear Algebra with Applications, fourth edition, Pearson

●Grade Assessment
Explained during the first class

●Notes

●Contacting Faculty
Email: darpo@math.nagoya-u.ac.jp

Fundamental Physics Tutorial IIａ (1.0credits) (物理学基礎演習２ａ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	John A. WOJDYLO Designated Professor		

●Course Purpose

This is a companion course to Fundamentals of Physics III, and offers practical exercises for mastering the concepts introduced in those lectures. Students enrolled in Fundamentals of Physics III are strongly urged ro enrol this tutorial course.The aims of this course are to deepen students' understanding of basic Physics ofelectricity and magnetism and to cultivate their ability to apply Physics knowledge to problem-solving.Students will significantly improve their understanding of the elementary Electricity and Magnetism introduced in the FPIII course, as well astheir proficiency in solving simple related problems.

●Prerequisite Subjects

Fundamentals of Physics 1 and 2. Concurrent enrolment in Fundamentals of Physics 3.

●Course Topics

Students must solve problems and present their solutions during the tutorial. Topics covered include (Chapter references are to the textbook by Resnick, Halliday and Walker):Chapter 21: Electric ChargeChapter 22: Electric FieldsChapter 23: Gauss' LawChapter 24: Electric PotentialChapter 25: CapacitanceChapter 26: Current and ResistanceChapter 27: CircuitsChapter 28: Magnetic FieldsChapter 29: Magnetic Fields Due to CurrentsChapter 30: Induction and Inductance

●Textbook

Resnick, Halliday and Walker, Wiley. Or WILEYPLUS Online.The WileyPlus website has many useful videos and worked examples. You should explore the resources available on that website

●Additional Reading

Leighton, R.B. & Feynman, R.P., Feynman Lectures on Physics (Volume 2), Pearson.This is a Year 2 level textbook, but even in Year 1 it is very useful.

●Grade Assessment

Class attendance is required. Absentee must give a valid reason.Class Attendance, performance and attitude: 10%; Assignments 45%; Tutorial reports, quizzes 45%.The "Absent (W)" grade is reserved for students who withdraw by the official deadline in May. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.If FPT2a is NOT A COMPULSORY SUBJECT and the student plans never to take FPT2a in the future, then a late withdrawal request will be considered.

●Notes

Live lectures via MS Teams (Online only). Before the start of semester students should ensure that they have correctly installed MS Teams using their Nagoya University email account.All lectures will be live via MS Teams (online only).A lecture video will be available immediately after each lecture to help with student revision.The lecturer will be available at most times during the day to answer questions via Teams chat.

●Contacting Faculty

Fundamental Physics Tutorial IIb (1.0credits) (物理学基礎演習２ｂ)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	Bernard GELLOZ Designated Associate Professor		

●Course Purpose

The aim of this course is to deepen students' understanding of basic Physics of waves and optics, and to cultivate their ability to apply Physics knowledge. Problem solving methods are introduced.This tutorial focuses on mechanical and electromagnetic waves, as well as optics. Students will train on both conceptual understanding and problem solving. Understanding waves and optics is important as preparation for more advanced subjects, for example in quantum mechanics, chemistry, and engineering.

●Prerequisite Subjects

The three courses Fundamentals of Physics I, II and III. Since this tutorial is designed to accompany Fundamentals of Physics IV, it is highly recommended to register for this course too if you have not already passed it.

●Course Topics

- Review of mechanical oscillations (part of chapter 15)- Short introduction to electromagnetic oscillations (part of chapter 30)- Fundamentals of waves and mechanical waves (chapter 15)- Introduction to Maxwell's equations (part of chapter 32)- Electromagnetic waves (chapter 33)- Images (geometrical optics) (part of chapter 34)- Optical interference (chapter 35)- Introduction to optical diffraction (part of chapter 36)

●Textbook

Fundamentals of Physics Extended 10th Edition International Student Version withWileyPLUS Set (John Wiley & Sons, 2010 ISBN-13: 978-1118230725)

●Additional Reading

Feynman Lectures On Physics (Vol. 2) by Richard Phillips Feynman (Pearson P T R)

●Grade Assessment

Online Assignments: 20%, Tutorial reports: 20%; quizzes: 60%.

●Notes

●Contacting Faculty

Analytical Chemistry (2.0credits) (分析化学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

The course will introduce the fundamentals of analytical chemistry and mainly focuses on classical but still widelyused wet chemical methods, combined with an overview of the instrumental techniques used in contemporarychemical analysis.

●Prerequisite Subjects

Fundamentals in Chemistry I, II. Laboratory in Chemistry

●Course Topics

Analytical Chemistry will cover the following topicsAcid - base equilibriaPrecipitation/gravimetryRedox equilibriaTitrationSpectrochemical methodsChromatography

●Textbook

Gary D. Christian; " ANALYTICAL CHEMISTRY, 7TH EDITION"; 2013; Publication Hoboken, N.J.: John Wiley & Sons

●Additional Reading

Jack Barrett, "Inorganic Chemistry in Aqueous Solutions", RSC Publishing, 2003, ISBN 0-85404-471-X

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system):TOTAL 100% = 100 ptsGrades: "S" = 100 - 90% (> 90 pts), "A" = 89 - 80% (9 - 80 pts), "B" = 79 - 70% (79 - 70 pts), "C" = 69 - 60% (69 - 60pts), "F" = 59 - 0% (< 60 pts)Face to face classes: Activity, homework: 10%, intermediate exam: 30%, final exam (comprehensive): 60%On-line classes: Reports: 65%, final exam (on-line): 35% The final exam is mandatory!Grades are final and calculated on the basis of the performances during class (reports in case of on-line classes) andin the two exams (one final exam in case of on-line classes) only. There will be no possibility to improve a grade afterthe final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasonscan ask the instructor.

●Notes

●Contacting Faculty

Either after the classes or during the office hours/by email (to be announced)E-mail: gsamjeske@chem.nagoya-u.ac.jp

Organic Chemistry I (2.0credits) (有機化学1)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Jiyoung SHIN Professor

●Course Purpose

This course was designed to promote an understanding of introductory organic chemistry and to help students build a logical framework for understanding fundamental organic chemistry. The primary purpose of this course is to help students build a logical framework for understanding fundamental organic chemistry. The course emphasizes how the organic molecular structures and the electron density compositions are related to patterns of organic chemical reactions. Participants are expected to investigate the mechanism of intramolecular or intermolecular organic reactions and solve the problem of progressive reaction sequences based on the knowledge learned through the course contents.

●Prerequisite Subjects

Fundamentals of Chemistry I and II

●Course Topics

Class 1. Structure Perspective of Organic Molecules --- Atomic Electron Configuration and Construction of Organic Molecules (Hybridization).
Class 2. Projection of Molecular Structures of Organic Molecules and Classification of the Isomers --- Constitutional (Chain, Position, and Functional Group) Isomers and Stereoisomers (Diastereomers and Enantiomers).
Class 3. Optical Activities of Stereoisomers and Assignment of Stereoisomeric Structures --- Fischer and Newman Projections; Absolute configurations(R/S) and Optically Observed (D/L) Rotations; Specific Rotation and Enantiomeric Purity; Meso Compound.
Class 4. Electron Density Configuration of Organic Molecules and Their Acidity/Basicity --- Formal Charges and Oxidation States; Acidity/Basicity and Electrophilicity/Nucleophilicity; Type of Chemical Reactions.
Class 5. Potential Energy Profiles for Kinetically and Thermodynamically Favorable Reactions --- Stability of Carbocations, Carbanions, Hydrocarbon Radicals, and the Stabilization Factors (Hyperconjugation and Resonances).
Class 6. Assessment of the Classes 1-5 with Practice Problems.
Class 7. General Trends of Aliphatic Nucleophilic Substitutions and Bimolecular Reactions (SN2) --- Efficient Substrates and Proper Leaving Groups; Reactivity of Nucleophiles and Solvent Effect; Stereochemistry; Competing Reactions.
Class 8. Unimolecular Aliphatic Nucleophilic Substitutions (SN1) --- Efficient Substrates and Proper Leaving Groups; Nucleophilicity and Solvolysis; Stability of Carbocation Intermediate; Stereochemistry; Competing Reactions.
Class 9. Aliphatic Eliminations --- Unimolecular (E1 and E1CB) and Bimolecular (E2) Eliminations; Thermodynamically and Kinetically favored (Zaitsev and Hofmann) Eliminations.
Class 10. Types of Nucleophiles and Haloalkanes and Their Reaction Trends/Overview (Substitutions & Eliminations).
Class 11. Assessment of the Classes 7-10 with Practice Problems.
Class 12. Nomenclature of Organic Compounds --- Saturated/Unsaturated Hydrocarbons; Functional Groups; Aromatic Hydrocarbons; Stereochemical Assignments; Fused Rings (Spiroalkanes and Bicyclo/Tricycloalkanes).
Class 13. Structures and Stereochemistry of Cycloalkanes and their Stability and Reactivity.
Class 14. Preparation of Haloalkanes (Radical Reactions) --- Potential Energy Profiles of Reaction Coordinates.

Class 15. Assessment of Overall Classes with Practice Problems (1-14).

●Textbook

Organic Chemistry: Structure and Function (Eighth Edition), Peter K. Vollhardt and Neil Schore, (W. H. Freeman and Company), New York, 2018, Chapters 1-7.

●Additional Reading

Organic Chemistry (second edition), Jonathan Clayden, Nick Greeves, and Stuart Warren (Oxford University Press), 2012 ISBN-10:0199270295.

●Grade Assessment

Examination [total 70%: two midterms (20% for each) and one final (30%)] and Assignment of Homework and Attendances (30%): S(x90), A(90>x80), B(80>x70), C(70>x60), and F(60>x) for the students who entered earlier than 2020; A+(95), A(95>xx80), B(80>x70), C(70>x65), C-(65>x60), and F(60x) for the students who entered in 2020 or later than 2020. The assessment methods will be reconsidered due to the change of the pandemic conditions.

●Notes

Submission of the "Course Withdrawal Request Form is necessary to withdraw the course. The student needs to contact the course instructor when the student wants to withdraw from the course. No submission of sickness/absence reports and lack of attendance score will result in an 'F' grade: It is for the protection of other attendances in the corresponding course from the frequent absences of the specific/uncertain student(s).

Students are recommended to prepare each lecture by reading the corresponding chapter in the textbook and to review it by solving the related homework questions. Each assignment should be submitted at the beginning of the next class. Late or no assignment submission is the deduction point of the grade.

●Contacting Faculty

Students can communicate with the course instructor face-to-face, either in the class or through the appointment. Communication through email (instructor's email: jyshin321(at)gmail.com) is also available. Participants can have lecture materials for the respective classes through NUCT. Sudden questions can be given to students during lectures to provide substantial feedback.

Physical Chemistry I (2.0credits) (物理化学1)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	PHUNG Quan manh Associate Professor

●Course Purpose

The purpose of this course is to grasp the physical basis of the interactions between particles and of the behavior and
properties of matter. The course begins with perfect gas law, proceeds to thermodynamics, and finishes with applications of thermodynamics to simple mixtures.

●Prerequisite Subjects

Fundamentals of Chemistry I and II

●Course Topics

1 Gases and the Zeroth Law of Thermodynamics 1 (Ch. 1)/
2 Gases and the Zeroth Law of Thermodynamics 2 (Ch. 1)/
3 The First Law 1 (Ch. 2)/
4 The First Law 2 (Ch. 2)/
5 The Second and Third Laws 1 (Ch. 3)/
6 The Second and Third Laws 2 (Ch. 3)/
7 Midterm Exam (Chs. 1 3)/
8 Gibbs Energy and Chemical Potential 1 (Ch. 4)/
9 Gibbs Energy and Chemical Potential 2 (Ch. 4)/
10 Introduction to Chemical Equilibrium (Ch. 5)/
11 Equilibria in Single-Component Systems (Ch. 6)/
12 Equilibria in Multiple-Component Systems (Ch. 7)/
13 Electrochemistry and Ionic Solutions (Ch. 8)/
14 Pre-final Review/
15 FINAL EXAM (Chs. 1 8)

●Textbook

David W. Ball: Physical Chemistry, 2nd Ed., Cengage Learning, 2015

●Additional Reading

Atkins' Physical Chemistry, any edition

●Grade Assessment

Two exams: the midterm (worth 50 points) and the final (comprehensive, worth 100 points), homework (40 points),
and 10 points for activity in online communication with the instructor and the class. TOTAL: 200 points.
Grade "S": 100-90% (180 or more points), "A": 89-80% (179 - 160 pts), "B": 79-70% (159 - 140 pts), "C": 69-60% (139
- 120 pts), "F": 59-0% (fewer than 120 pts).

●Notes

●Contacting Faculty

E-mail: pbutko@chem.nagoya-u.ac.jp

Biochemistry I (2.0credits) (生化学１)

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Seiji KOJIMA Professor	Shunji NAKANO Lecturer

●Course Purpose

The purpose of this course is to introduce the biomolecules and their contributions to life. The basic property ofwater, nucleic acid, amino acid and protein will be included in the lectures.

●Prerequisite Subjects

Biochemistry II, III, and IV (Terms IV, V, and VI, respectively)

●Course Topics

1. Life, cells, and thermodynamics2. Physical and chemical properties of water3. Overview of DNA structure, function and engineering4. Amino acids: the building blocks of proteins5. Polypeptide sequences, analysis, and evolution6. Protein Structure and folding7. Physiological activities of proteinsIt is desirable to read a textbook or reference materials before a class

●Textbook

1. Principles of Biochemistry by Voet, D., Voet, J.G. and Pratt, C.W., Wiley and son, Inc. USA. ISBN: 78-11809244-6,4th edition2. Biochemistry by Berg, Tymoczko, Stryer, 8th edition.3. Lehninger Principles of Biochemistry by Nelson and Cox, 7th edition.

●Additional Reading

Recommended reading will be suggested in the class.

●Grade Assessment

Evaluation will be based on in-class participation, quizzes, assignments and examinations. Presence will be marked.Lecture participation will be considered an important element in overall grading.Absent based on submission of Course Withdrawal Request Form.Fail based on “Failed” results of examinations and assignments.

●Notes

●Contacting Faculty

E-mail (Seiji Kojima: z47616a@cc.nagoya-u.ac.jp) or phone (052-789-2993).

Cell Biology I (2.0credits) (細胞学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Seiji KOJIMA Professor

●Course Purpose

Aims: This course aims to develop students’ foundation in basic cell organization.The course provides students with an overview of cell structure, proteins structure and function, and fundamentalgenetic processes in the cell.

●Prerequisite Subjects

Fundamentals of Biology I

●Course Topics

1. Basic cell organization;2. Protein structure and function;3. Structure of DNA and chromosomes;4. DNA replication, repair and recombination;5. DNA expression6. Control of gene expression7. Introduction to evolutionary biology8. Introduction to molecular biology methodsAssignments and preparations outside of class hours: students are required to prepare for each class by reading theassigned textbook content and preparing a short schematic summary of important concepts before class.

●Textbook

Essential Cell Biology, B. Alberts et al., Garland Science.

●Additional Reading

Becker`s world of the cell, Hardin, Bertoni, Kleinsmith, Pearson.Molecular Biology of the Cell, B. Alberts et al., Taylor & Francis.

●Grade Assessment

Evaluation is based on class participation, assignments and examinations. A total score of at least 60/100 is requiredto receive a passing grade.

●Notes

●Contacting Faculty

E-mail: mnvassileva@bio.nagoya-u.ac.jp

Analytical Mechanics I (2.0credits) (解析力学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	SHIGEMORI Masaki Designated Professor

●Course Purpose

This is the first of two courses in analytical mechanics. Analytical mechanics abstracts from Newtonian mechanicsand generalizes it to a versatile framework that can be applied to various areas of physics, such as quantummechanics, statistical mechanics, and relativity. After a survey of elementary principles, we discuss the core conceptsof Lagrangian and Hamiltonian mechanics, with special emphasis on symmetry principles, followed by some explicitexamples.

●Prerequisite Subjects

Analytical Mechanics II, Quantum Mechanics I

●Course Topics

1. Survey of elementary principles2. Variational principles and Lagrangian mechanics3. Symmetries and conservation laws4. Hamiltonian mechanics5. Central force problemIt is desirable to read a textbook or reference materials before a class

●Textbook

H. Goldstein, C. Poole and J. Safko, "Classical Mechanics", Pearson; 3rd edition (2013), ISBN-10: 1292026553,ISBN-13: 978-1292026558

●Additional Reading

L. D. Landau and E. M. Lifschitz, "Mechanics: Volume 1 (Course of Theoretical Physics)", Butterworth-Heinemann; 3rdedition (1976), ISBN-10: 0750628960, ISBN-13: 978-0750628969.L. N. Hand and J. D. Finch, "Analytical Mechanics", Cambridge University Press (1999), ISBN-10: 0521575729,ISBN-13: 978-0521575720.

●Grade Assessment

Quizzes 10%, homework 30%, midterm 30%, final exam 30%

●Notes

●Contacting Faculty

Join and check the NUCT website for Analytical Mechanics (AM1) for announcements.

Mathematical Physics I (2.0credits) (数理物理学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	John A. WOJDYLO Designated Professor

●Course Purpose

This course is a companion course to Mathematical Physics II. Students master analytical techniques for problemsthat arise in physics, engineering and chemistry. This course introduces first order and second order ordinarydifferential equations and their solution methods. Questions of uniqueness of solutions and convergence are alsodiscussed. Students are also introduced to Fourier series, the Fourier transform, convolution, Laplace transform, andthe Dirac delta function. Students will find this mathematical methods course helpful in other units such as QuantumMechanics, Analytical Mechanics, Electricity and Magnetism, as well as in Automotive Engineering and otherengineering courses. This course has dual aims: 1) to convey mathematical principles; 2) to improve students'technical ability i.e. ability to express intuition in mathematical terms and ability to solve problems.

●Prerequisite Subjects

Calculus I; Calculus II; Linear Algebra I; Linear Algebra II, or Consent of InstructorMathematical Physics Tutorial I, Mathematical Physics II

●Course Topics

• First order ordinary differential equation (ODE) initial value problems. Integration factor; separable equations;systems of ODEs (Hamiltonian systems); phase plane, flow. Uniqueness and existence theorems. Some differencesbetween linear and nonlinear ODEs.• Second order linear ODE initial value problems. Homogeneous solution. Proving linear independence (Wronskian).Method of Undetermined Coefficients; Variation of Parameters. Series solutions: ordinary point, regular singularpoint; convergence tests; Method of Frobenius. Examples from physics and engineering.• Fourier series. Dirichlet conditions. Role of symmetry. Gibbs phenomenon. Effect of jump discontinuity on speed ofconvergence. Integration and differentiation of Fourier series.• Fourier transform, convolution, Dirac delta function. Laplace transform.

●Textbook

Boyce W., DiPrima R, Elementary Differential Equations, 7th 10th Ed., Wiley.

●Additional Reading

1.Boas M.L., 2006, Mathematical Methods in the Physical Sciences, 3rd ed., John Wiley & Sons.2.Strang, G., Introduction to Linear Algebra, 4th Edition, Chapter 6.3.Arfken G.B. & Weber H.J., 2005, Mathematical Methods for Physicists, 6th ed., Elsevier Academic Press. (Copiesare available in the library.)

●Grade Assessment

Attendance: 5%; Weekly Quizzes and Assignments: 25%; Mid-term exam: 35%; Final Exam: 35%The "Absent" grade is reserved for students who withdraw by November 16. After that day, a letter grade will beawarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

Office: Science Hall 5F 517Phone: 052-789-2307Email: john.wojdylo@s.phys.nagoya-u.ac.jp

Mathematical Physics Tutorial I (1.0credits) (数理物理学演習１)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	KITAHARA Teppei Designated Assistant Professor

●Course Purpose

Students taking Mathematical Physics I should also take this tutorial class. This course introduces first-order andsecond-order ordinary differential equations and their solution methods. Students master exact and approximateanalytical techniques for initial value problems that arise in physics, engineering and chemistry. Questions ofexistence, uniqueness and convergence are also discussed. Fourier series follow naturally from the 2nd-order theoryand these are investigated, too.

●Prerequisite Subjects

Calculus I, Calculus II, Linear Algebra I, Linear Algebra II;or Consent of Instructor

●Course Topics

• First order ordinary differential equation (ODE) initial value problems. Integration factor; separable equations;systems of ODEs (Hamiltonian systems); phase plane, flow. Uniqueness and existence theorems. Some differencesbetween linear and nonlinear ODEs.• Second order linear ODE initial value problems. Homogeneous solution. Proving linear independence (Wronskian).Method of Undetermined Coefficients; Variation of Parameters. Series solutions: ordinary point, regular singularpoint; convergence tests; Method of Frobenius. Examples from physics, engineering and chemistry.• Fourier series. Dirichlet conditions. Role of symmetry. Gibbs phenomenon. Effect of jump discontinuity on speed ofconvergence. Integration and differentiation of Fourier series.• Fourier transform, convolution, Dirac delta function. Laplace transform.

●Textbook

There is no designated textbook, but lecture materials will be handed out at every class.

●Additional Reading

1. Boas M.L., 2006, Mathematical Methods in the Physical Sciences, 3rd ed., John Wiley & Sons.2. Strang, G., Introduction to Linear Algebra, 4th Edition, Chapter 6.3. Arfken G.B. & Weber H.J., 2005, Mathematical Methods for Physicists, 6th ed., Elsevier Academic Press. (Copies areavailable in the library.)

●Grade Assessment

tutorial Attendance: 50%; Class performance: 50%The “Absent” grade is reserved for students who withdraw by November 14.After that day, a letter grade will be awarded based on marks earned fromall assessments during the semester.

●Notes

●Contacting Faculty

Instructor: KITAHARA TeppeiOffice: ES Building, ES714Phone: 052-789-2863Email: teppeik@kmi.nagoya-u.ac.jp

Statistical Physics I (2.0credits) (統計物理学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Yasumasa ITO Associate Professor

●Course Purpose
The main focus of this course is the basic principles of thermodynamics, which means not only classic thermodynamics but also chemical reaction and energy conversion.

It is expected that, after the course, students aquire basic knowledge of thermodynamics. It is also expected that students can explain the fundamentals for macroscopic physical phenomena and calcuate engineering problems such as thermal efficiency of heat engines.

●Prerequisite Subjects
Calculus, linear algebra, fundamentals of physics

●Course Topics
1. Thermal Equilibrium and Temperature, and State Equations
2. The First Law of Thermodynamics
3. The Second Law of Thermodynamics and Carnot Cycle
4. Entropy
5. Free Energy
6. Thermodynamic Functions
7. Phase Equilibrium and Chemical Equilibrium
8. Heat engines

Exercise session follow every other week. Part of problems are assigned as homework.

●Textbook
Handouts will be provided.

●Additional Reading
Thermodynamics -an engineering approach- (McGrawHill)

●Grade Assessment
Mainly final exam and midterm exam but homework will be taken into account too.

Full mark is 100 points and 60 points is the minimum requirement to earn credits.

●Notes
No specific subjects.

●Contacting Faculty
Message through NUCT. If students can't use it for some reason, email to yito@nagoya-u.jp.

Inorganic Chemistry I (2.0credits) (無機化学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

Inorganic chemistry I is the first part of a three-semester course in inorganic chemistry consisting of parts I, II, and III. Aim of the three-semester course is to present principles and fundamentals of inorganic chemistry, to introduce chemical reactions and to show examples of the role of inorganic chemistry in the industry, environment and every day lives.At the end of the complete course (Inorganic Chemistry I, II, III), students should have learned a robust foundation in physical inorganic principles and also applications of the subject to catalysis and industrial processes.

●Prerequisite Subjects

Fundamentals of Chemistry I and II, (Laboratory in Chemistry), Analytical Chemistry

●Course Topics

The course Inorganic Chemistry I will be structured as follows:Class 1: Introduction to Inorganic Chemistry & Structure of the atomClass 2: Buil-up principle & Introduction to bonding modelsClass 3: Octet rule, electronegativity & dipole momentsClass 4: Introduction to MO theory and VSEPRClass 5: Introduction to molecular symmetryClass 6: Point groups & character tablesIntermediate examClass 7: Introduction to vibrational spectroscopyClass 8: Chirality ans chiral moleculesClass 9: Introduction to bonding in polyatomic molecules & ligand group orbitals (LGO)Class 10: MO apllied to polyatomic moleculesClass 12: Aqueous solutions, oxoacids & aquated cationsClass 13: Introduction to experimental techniquesFinal exam (comprehensive)Depending on the situation a shift of topics between classes might happen

●Textbook

Catherine E. Housecroft, Alan G. Sharpe; INORGANIC CHEMISTRY, 5TH EDITION; PEARSON - PRENTICE HALL

●Additional Reading

Pfennig, Brian William: "Principles of Inorganic Chemistry", 2015, John Wiley & Sons, Inc., ISBN 978-1-118-85910-0

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system) or since AY2020 (6 letter system):maximum TOTAL 100% (= 100 pts)Homework submission: 10% (= 10 points)Intermediate exam: 40% (= 40 pts)Final exam (comprehensive): 50% (= 50 pts)The intermediate and final exam are mandatory!Grades are final and calculated on the basis of the performances during class (homework submission) and in the two exams only. There will be no possibility to improve a grade after the final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasons can ask the instructor.The course will be graded "F" (failed) if less than 60% of the total points were obtained. The course will be graded as "absent" ("A" or "W") if withdrawal was applied before the intermediate exam, as stated in "course withdrawal"

●Notes

Face-to-Face class and remote class (on-demand class) combined.

●Contacting Faculty

Either after the classes or during the office hours/by email (to be announced)E-mail: gsamjeske@chem.nagoya-u.ac.jpQuestions should be asked by email (NOT the messaging system) or by making an appointment for a ZOOM or MS Teams meeting

Organic Chemistry II (2.0credits) (有機化学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Jiyoung SHIN Professor

●Course Purpose

This course was designed to promote an understanding of introductory organic chemistry and to help students build a logical framework for understanding fundamental organic chemistry. The primary purpose of this course is to acquire a logical framework for understanding fundamental organic chemistry. This framework influences for chemical reactions of the organic molecules having -bonds. Based on the knowledge of the course contents, the participants are expected to understand organic reaction sequences happening with unsaturated organic molecules, including aromatic compounds, and solve the progressive problems sequentially.

●Prerequisite Subjects

Fundamental Chemistry I and II, and Organic Chemistry I

●Course Topics

Class 1. Electron Configuration of Unsaturated Hydrocarbons and Their Reaction Trends --- Difference of Reactivity between Saturated and Unsaturated Aliphatic Hydrocarbons and Aromatic Hydrocarbons.
Class 2. Nuclear Magnetic Resonance (NMR) Spectroscopy of Organic Molecules --- Level of Energy Source for Various Spectroscopy; Larmor Frequency and Quantized Energy; Spin Spinning and Applied Magnetic Field; Zeeman Effect and Resonances; Shielding and Deshielding; Downfield and Upfield; Chemical Shifts, Integration, and Peak Splitting; [N+1] rule.
Class 3. Preparations of Alkenes and Sequence of Electrophilic Additions of Alkenes --- Potential Energy Stability of Unsaturated Aliphatic Compounds and Electrophilic Additions; Preparations by E2 Elimination and Dehydration; Hydrogenation; Halogenations (toward Monohaloalkane, Dihaloalkane, Halohydrin, and Allylic halide) of Simple Alkenes and Conjugated Dienes.
Class 4. Electrophilic Additions of Alkenes --- Hydration; Carbene Addition; Oxidation; Radical Addition; Heck Coupling; Polymerization.
Class 5. Assessment of the Classes 1-4 with Practice Problems.
Class 6. Reactions of delocalized pai-systems (Diels-Alder Reactions and Electrocyclization) --- Efficient Dienes and Dienophiles; Stereochemistry in Diels-Alder Reactions (Endo/Exo cycloadditions and Endo Rule); Thermal and Photochemical Cyclization for Even- and Odd-Numbered Double Bonds.
Class 7. Preparations of Alkynes and Sequence of Electrophilic Additions of Alkenes --- Hydrogenation; Halogenation; Hydration.
Class 8. Delocalized -Systems and Reactivity of Benzene --- Stability of Extended Conjugations and the Electron Configuration of Delocalized -Systems (Nonaromatic/Aromatic/Antiaromatic Compounds); Projection of Resonances.
Class 9. The reaction of Benzene --- Electrophilic Aromatic Substitutions (Halogenation, Nitration, Sulfonation, Friedel-Crafts Alkylation, Friedel-Crafts Acylation, Wolff-Kishner and Clemmensen Reductions).
Class 10. Assessment of the Classes 6-9 with Practice Problems.
Class 11. Electrophilic Substitutions of Substituted Benzenes --- ortho & para-Directing and meta-Directing Groups and the Reactivities
Class 12. Nucleophilic Substitutions of Benzene (via Benzyne Formation or through Inductive Effects of Substituents).
Class 13. Preparations of Multiply Substituted Benzenes --- Protection/Deprotection of amine; Reduction/Oxidation.
Class 14. Electrophilic Substitutions of Fused Aromatic Compounds (Naphthalene and Anthracene).

Class 15. Assessment of the Overall Classes (1-14) with Practice Problems.

●Textbook

Organic Chemistry: Structure and Function (Eighth Edition), Peter K. Vollhardt and Neil Schore, (W. H. Freeman and Company), New York, 2018, Chapters 11-16 and 22

●Additional Reading

Organic Chemistry (second edition), Jonathan Clayden, Nick Greeves, and Stuart Warren (Oxford University Press), 2012 ISBN-10:0199270295.

●Grade Assessment

Examination [total 70%: two midterms (20% for each) and one final (30%)] and Assignment of Homework and Attendances(30%): S(x90), A(90>x80), B(80>x70), C(70>x60), and F(60>x) for the students who entered earlier than 2020; A+(95), A(95>xx80), B(80>x70), C(70>x65), C-(65>x60), and F(60x) for the students who entered in 2020 or later than 2020. The assessment methods will be reconsidered due to the change of the pandemic condition.

●Notes

Submission of the "Course Withdrawal Request Form is necessary to withdraw the course. The student needs to contact the course instructor when the student wants to withdraw from the course. No submission of sickness/absence reports and lack of attendance score will result in an 'F' grade: It is for the protection of other attendances in the corresponding course from the frequent absences of the specific/uncertain student(s).

Students are recommended to prepare each lecture by reading the corresponding chapter in the textbook. Also, Students are recommended to review it by solving the related homework questions. Each assignment is due by the start of the next class. Late or no submission of the assignment is the deduction point of the grade.

●Contacting Faculty

Students can communicate with the course instructor face-to-face, either in the class or through the appointment. Communication through emails (instructor's email: jyshin321(at)gamil.com) is also available. Participants can have the lecture material for each class through NUCT. Sudden questions will be given to students during lectures to provide substantial feedback.

Physical Chemistry II (2.0credits) (物理化学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	PHUNG Quan manh Associate Professor

●Course Purpose

The purpose of this course is to learn what physical chemistry is all about and to grasp important principles and facts about physical chemistry. The focus is on statistical thermodynamics and its applications, kinetics, and dynamics of chemical reactions.

By the end of this course, students should be equipped with knowledge and skills concerning the following:
1) Calculate thermodynamics quantities with statistical thermodynamics
2) Calculate reaction rates with chemical kinetics
3) Understand what happens to molecules at the climax of reactions with collision and TS theories
4) Understand chemical processes at surfaces

●Prerequisite Subjects

Physical Chemistry I

●Course Topics

1 Statistical Thermodynamics: Introduction
2 More Statistical Thermodynamics - 1
3 More Statistical Thermodynamics - 2
4 The Kinetic Theory of Gases
5 Chemical Kinetics - 1
6 Chemical Kinetics - 2
7 MIDTERM EXAM
8 Reaction Dynamics - 1
9 Reaction Dynamics - 2
10 The Solid State - 1
11 The Solid State - 2
12 Surfaces - 1
13 Surfaces - 2
14 Pre-Final Review
15 FINAL EXAM

●Textbook

David W. Ball: Physical Chemistry, 2nd Ed., Cengage Learning, 2015

●Additional Reading

P. Atkins, J. de Paula & J. Keeler: Atkins’ Physical Chemistry, 11th Ed., Oxford University Press, 2018

●Grade Assessment

Midterm exam: 100 points, final exam (comprehensive): 200, homework: 100. TOTAL: 400.
Old scheme: Grade "S": 100-90%, "A": 89-80%, "B": 79-70%, "C": 69-60%, "F": 59-0%.
New scheme: Grade "A+": 100-95%, "A": 94-80%, "B": 79-70%, "C": 69-65%, "C-": 64-60% "F": 59-0%.

●Notes

The course might be (partially) online.

Homework is crucial for mastering new material and developing skills in applying concepts. Weekly homework will be either on paper or electronic. Homework is due at the beginning of class on the due date.

A general guideline says an average of 2 to 3 hours of study time per week is necessary for each 1 credit hour.

Exams focus on problem-solving, and exam questions will be similar to the homework problems. Exam grades will be posted in the Gradebook on the Course website before the next class period.

●Contacting Faculty

Office: SA Building 318-1 (Science & Agriculture)
Phone: 789-2480
E-mail: pbutko@chem.nagoya-u.ac.jp

Quantum Chemistry I (2.0credits) (量子化学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	PHUNG Quan manh Associate Professor

●Course Purpose

"What exactly is so special about Quantum Mechanics?" The purpose of this course is to introduce quantum mechanics. It begins with an introduction to elementary quantum mechanics and builds up to convey a thorough theoretical understanding of atomic electronic structure.

The goal is to lay the foundation of Quantum Theory and see how it helps explain the atomic and molecular structure and chemical bond and reactivity.

●Prerequisite Subjects

Fundamentals of Chemistry I and II, Fundamentals of Physics I and II, Calculus I, Linear Algebra I and II, or permission of the instructor

●Course Topics

1 From Classical to Quantum Mechanics (Ch. 1)
2 Wave Packets and the Schrodinger Equation (Ch. 2)
3 The Quantum Mechanical Postulates (Ch. 3)
4 The Particle in the Box 1 (Ch. 4)
6 The Particle in the Box 2 (Ch. 5)
7 Commuting and Non-commuting Operators and the Uncertainty Principle (Ch. 6)
8 MIDTERM EXAM
9 Quantum Mechanical Model for the Vibration and Rotation of Molecules - 1 (Ch. 7)
10 Quantum Mechanical Model for the Vibration and Rotation of Molecules - 2 (Ch. 7)
11 The Vibrational and Rotational Spectroscopy of Diatomic Molecules - 1 (Ch. 8)
12 The Vibrational and Rotational Spectroscopy of Diatomic Molecules - 2 (Ch. 8)
13 The Hydrogen Atom (Ch. 9)
14 Pre-Final Review
15 FINAL EXAM

●Textbook

T. Engel: Quantum Chemistry and Spectroscopy, 3rd Ed. (International edition), Pearson, 2014

●Additional Reading

David W. Ball: Physical Chemistry, 2nd Ed., Cengage Learning, 2015
P. Atkins, J. de Paula, and J. Keeler: Atkins' Physical Chemistry, 11th Ed. Oxford University Press, 2018
D. A. McQuarrie and J. D. Simon "Physical Chemistry A Molecular Approach"

●Grade Assessment

Midterm exam: 100 points, final exam (comprehensive): 200, homework: 100. TOTAL: 400.
Old scheme: Grade "S": 100-90%, "A": 89-80%, "B": 79-70%, "C": 69-60%, "F": 59-0%.
New scheme: Grade "A+": 100-95%, "A": 94-80%, "B": 79-70%, "C": 69-65%, "C-": 64-60% "F": 59-0%.

●Notes

The course might be (partially) online.

Homework is crucial for mastering new material and developing skills in applying concepts. Weekly homework will be either on paper or electronic. Homework is due at the beginning of class on the due date. A general guideline says an average of 2 to 3 hours of study time per week is necessary for each 1 credit

hour.

Exams focus on problem-solving, and exam questions will be similar to the homework problems. Exam grades will be posted in the Gradebook on the Course website before the next class period.

●Contacting Faculty

pbutko@chem.nagoya-u.ac.jp

Biochemistry II (2.0credits) (生化学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Elective
Lecturer	Seiji KOJIMA Professor

●Course Purpose

We will continue to learn the biochemical basis of living organisms.The first part covers the structures and functions of the essential macromolecules, sugar and lipids, in biological systems. The 2nd part covers biochemical principles of cellular physiology focusing on how the cells communicate with outside as well as within its own inside. The goal is to understand how the structure and properties of biochemical molecules work to perform necessary functions to sustain life.

●Prerequisite Subjects

Biochemistry I

●Course Topics

1. Review of Biochemistry I2. Saccharide chemistry3. Lipids, Bilayer, and membranes4. Passive and active transport5. Mechanisms of enzyme action6. Properties of enzymes7. Hormones and signal transduction

●Textbook

1. Principles of Biochemistry by Voet, D., Voet, J.G. and Pratt, C.W., Wiley and son 4th edition.2. Biochemistry by Berg, Tymoczko, Stryer, 8th edition.3. Lehninger Principles of Biochemistry by Nelson and Cox, 7th edition.

●Additional Reading

Recommended reading will be suggested in the class.

●Grade Assessment

Evaluation will be based on in-class participation, assignments and examinations.Equal to or above 60% is required to pass Absent based on submission of Course Withdrawal Request Form.Fail based on “Failed” results of examinations and assignments.

●Notes

Classroom in person style with real time online distribution by using zoom. The lecture will be recorded and stored in the NUSS storage site.

●Contacting Faculty

Cell Biology II (2.0credits) (細胞学２)

Course Type	Basic Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry		
Starts 1	2 Autumn Semester		
Elective/Compulsory	Elective		
Lecturer	Maria VASSILEVA Designated Associate Professor	DAMNJANOVIC Jasmina Assistant Professor	Joyce A. CARTAGENA Designated Associate Professor

●Course Purpose

Aims: this course provides students with knowledge on cellular membranes structure and its fundamental importancefor cellular processes - intracellular transport, cell communication and responses to the environment. Furthermore,the course provides details on the mechanisms of how plant and animal cells generate energy.

●Prerequisite Subjects

Fundamentals of Biology 1

●Course Topics

1. Membrane structure and function2. Intracellular Compartments and Transport;3. Cell Communication;4. How cells obtain energy from food5. Energy Generation in Mitochondria and Chloroplasts.Preparation outside the class hours: students are required to prepare before class by reading the assigned textbookmaterial and creating schematic summary of important concepts before class.

●Textbook

Essential Cell Biology, B. Alberts et al., Garland Science.

●Additional Reading

Becker`s world of the cell, Hardin, Bertoni, Kleinsmith, Pearson.Molecular Biology of the Cell, B. Alberts et al., Taylor & Francis.

●Grade Assessment

Evaluation is based on in-class participation, assignments and examinations. Passing grade requires a total cumulativegrade of minimum 60/100.

●Notes

●Contacting Faculty

mnvassileva@bio.nagoya-u.ac.jp

Electricity and Magnetism (2.0credits) (電磁気学)

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	Automotive Engineering
Starts 1	2 Spring Semester	2 Spring Semester
Elective/Compulsory	Elective	Compulsory
Lecturer	John A. WOJDYLO Designated Professor	

●Course Purpose

This course is a solid introduction to electrostatics and magnetostatics, as well as elementary electro- and magnetodynamics. It covers the first half of the textbook by Griffiths.

NOTE TO INTERNATIONAL EXCHANGE STUDENTS: this course assumes knowledge of vector calculus. We do not have time to reteach the basics that Nagoya University students have already learned. You must have a good grasp of vector calculus to take this course.

By the end of the course, students will have gained an intuitive as well as quantitative understanding of the basic physical principles of electromagnetism, as well as familiarity -- and hopefully mastery -- of some of the fundamental mathematical methods required to solve problems in physics, engineering, chemistry and applied mathematics.

This course has dual aims: 1) to convey physical and mathematical principles relevant to solving applied problems in physics, engineering and chemistry; 2) to improve students' technical ability – i.e. ability to express intuition in mathematical terms and ability to solve problems.

The course objective is to enable students to master each point in the course plan as outlined below, to the level of the first half of the textbook by Griffiths.

●Prerequisite Subjects

Calculus I&II; Mathematical Physics II or Consent of Instructor.

Students MUST have previously performed strongly in a vector calculus course.

●Course Topics

Participants are expected to prepare solutions to problems relating to the lecture course content, which are handed out by the EM1 lecturer, and present their solutions on the whiteboard (or online using MS Teams) during the tutorial course (Physics Tutorial IIa).

Course outline.

1. Revision of vector calculus, curvilinear coordinates, Dirac Delta Function.

2. Electrostatics. Coulomb's Law. Continuous Charge Distributions. Divergence and Curl of Electrostatic Fields. Field Lines, Flux, and Gauss's Law. Electric Potential. Poisson's Equation and Laplace's Equation. The Potential of a Localized Charge Distribution. Physical meaning of the Dirac delta function in the context of Poisson's Equation.

3. Work and Energy in Electrostatics. Conductors. Induced Charges. Surface Charge and the Force on a Conductor. The Method of Images: point charge near a conducting plane or sphere, grounded or insulated. Separation of Variables.

4. Electric Fields in Matter. Polarization. Dielectrics. The Electric Displacement. Linear Dielectrics.

5. Magnetostatics. The Lorentz Force Law. The Biot-Savart Law. The Divergence and Curl of B. Applications of Ampere's Law. Magnetic Vector Potential A. Gauge transformations.

6. Magnetic Fields in Matter. Magnetization. Diamagnetism, Paramagnetism, Ferromagnetism. The Auxiliary Field H. Magnetic Susceptibility and Permeability.

7. Introduction to Electrodynamics. Electromotive Force. Electromagnetic Induction. Faraday's Law. Energy in Magnetic Fields. Maxwell's Equations. Magnetic levitation.

●Textbook

1. Griffiths, D.L., 2012, Introduction to Electrodynamics, 4th ed., Prentice Hall.

Alternative textbook (HIGHLY RECOMMENDED):
2. Purcell, E.M. and Morin, D. J., Electricity and Magnetism, 3rd Ed., Cambridge University Press

(It is essential that students read at least one of these books.)

●Additional Reading

1. Leighton, R.B. & Feynman, R.P., Feynman Lectures on Physics (Volume 2), Pearson.
(Highly recommended.)

2. Boas, Mary, Mathematical Methods in the Physical Sciences 3rd Ed., Wiley (2005). (Intuitive and well-explained introduction to much of the basic mathematics students need to master in undergraduate physics, including vector calculus.)

3. Jackson, J. D., Classical Electrodynamics, 3rd Edition, 1998. (Advanced reference.)

Even if at this stage you can’t understand much of the theory in the book by Jackson, you can occasionally “consult Professor Jackson” and understand a page or more, and also look at the fascinating graphs of solutions. You can learn a lot doing even this.

●Grade Assessment

Attendance and class performance, attitude: 5%; Weekly quizzes or other written assessment: 30%; Midterm exam: 32.5%; Final Exam: 32.5%

The "Absent (W)" grade is reserved for students who withdraw by the official deadline in May. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.

If Electricity and Magnetism I is NOT A COMPULSORY SUBJECT and the student plans never to take Electricity and Magnetism I in the future, then a late withdrawal request will be considered.

●Notes

Live lectures via MS Teams (Online only). Before the start of semester students should ensure that they have correctly installed MS Teams using their Nagoya University email account.

●Contacting Faculty

Office: Science Hall 5F 517
Phone: 052-789-2307
Email: john.wojdylo@s.phys.nagoya-u.ac.jp

All lectures will be live via MS Teams (online only).

A lecture video will be available immediately after each lecture to help with student revision.

The lecturer will be available at most times during the day to answer questions via Teams chat.

Inorganic Chemistry II (2.0credits) (無機化学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

Inorganic chemistry II is the second part of a three-semester course in inorganic chemistry I, II, and III. Aim of thethree-semester course is to present principles and fundamentals of inorganic chemistry and also to show examples ofthe role of inorganic chemistry in the industry, environment and every day lives.

●Prerequisite Subjects

Fundamentals of Chemistry I and IIRelated CoursesINORGANIC CHEMISTRY I

●Course Topics

The contents of Inorganic Chemistry II will cover the topics ofMetals & non-metals: Solid stateRedox reactionsNon-aqueous solventss,p-block element chemistryIt is desirable to read a textbook or reference materials before a class

●Textbook

Catherine E. Housecroft, Alan G. Sharpe; INORGANIC CHEMISTRY, 5TH EDITION; PEARSON - PRENTICE HALL

●Additional Reading

Jack Barrett, "Inorganic Chemistry in Aqueous Solutions", RSC Publishing, 2003, ISBN 0-85404-471-XCotton, Wilkinson, "Advanced Inorganic Chemistry", John Wiley & Sons, Inc., ISBN 0-471-19957-5

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system):TOTAL 100% = 100 ptsGrades: "S" = 100 - 90% (> 90 pts), "A" = 89 - 80% (9 - 80 pts), "B" = 79 - 70% (79 - 70 pts), "C" = 69 - 60% (69 - 60pts), "F" = 59 - 0% (< 60 pts)Face to face classes: Activity, homework: 10%, intermediate exam: 30%, final exam (comprehensive): 60%On-line classes: Reports: 65%, final exam (on-line): 35% The final exam is mandatory!Grades are final and calculated on the basis of the performances during class (reports in case of on-line classes) andin the two exams (one final exam in case of on-line classes) only. There will be no possibility to improve a grade afterthe final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasonscan ask the instructor.

●Notes

●Contacting Faculty

Either after the classes or during the office hours/by email (to be announced)E-mail: gsamjeske@chem.nagoya-u.ac.jp

Structural Chemistry (2.0credits) (構造化学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Hideo TAKAGI Associate Professor

●Course Purpose

In this course, students will learn theoretical concepts that control structures and reaction pathways of chemicalcompounds without using complicated mathematics. For this purpose, students will learn basic concepts of the grouptheory in the first half of this course. Students will learn various point groups, structures of character tables, andbasic mathematical techniques related to the group theory.Then students will learn first- and second-order Jahn-Teller effects that are related to the distortions of ground-statestructures and the activation energy of chemical reactions. Finally, the students will learn symmetry rules thatdetermine the pathways of reactions.By taking this course, students will understand (1) symmetry elements and symmetry operations of various pointgroups; (2) methods of mathematical calculations using character tables; (3) method to draw molecular orbital byobtaining group orbitals; (4) analyses of normal mode vibrations of simple molecules by leaning the whole moleculemethod and internal coordinate method; (5) judgment if a given dipole transition is allowed or not; (6) determinationsof ground-state structures of various compounds; and (7) judgment if a given reaction is allowed to proceed thermally/ photochemically or not. Students also learn about basic mathematics related to the projection operators and theGreat Orthogonality Theorem.

●Prerequisite Subjects

chemistry

●Course Topics

1. Symmetry elements / operations and point groups2. Structure of character tables, reducible and irreducible representations, and direct product3. Kugel Group and subgroup4. Application of Group Theory 1: group orbital and molecular orbital5. Application of Group Theory 2: analyses of normal mode vibrations and basic concepts of IR / Raman spectroscopy6. Application of Group Theory 3: judgments of electronic / IR / Raman transitions7. Application of Group Theory 4: Jahn-Teller Theorem and structures of compounds8. Application of Group Theory 5: Allowed and forbidden reactions; Adiabaticity ofconcerted processes; Symmetry Rules and Principle of Least MotionIt is desirable to read a textbook or reference materials before a class

●Textbook

Theories for Structures and Reactions; A Practical Guide to the Physical Theories in Chemistry (by HDT)

●Additional Reading

S.F.A. Kettle, Symmetry and Structure a Readable Group Theory for Chemists, Wiley, and other books referred to in the textbook.

●Grade Assessment

Final examination (50%), assignments (50 %).

●Notes

●Contacting Faculty

E-mail / phonePhone: 789-5473 E-mail: h.d.takagi@nagoya-u.jp

Organic Chemistry III (2.0credits) (有機化学３)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Jiyoung SHIN Professor

●Course Purpose

This course was designed to promote an understanding of organic chemistry and to help students build a logical framework for understanding the principle knowledge. The primary purpose of the course is to master a logical framework for understanding fundamental organic chemistry. The outlines essentially provide the reactions of the organic compounds having critical functional groups, such as hydroxy, carbonyl, and amino groups, as well as their derivatives. Students are expected to understand the organic chemical reactions transforming one functional group into another and solve progression problems based on the knowledge learned through the course contents.

●Prerequisite Subjects

Fundamentals of Chemistry I and II, and Organic Chemistry I and II

●Course Topics

Class 1 & 2. Alcohols and Ethers --- Acidity/Basicity of Alcohols; Preparation of Alcohols (Nucleophilic Substitutions (SN1 & SN2), Reduction of Carbonyl Compounds, Hydrolysis of Esters); Reaction of Alcohols (Deprotonation, Substitution, Elimination, Oxidation, Inorganic Ester Formation); Preparation of Ethers (Williamson Ether Synthesis) and Reaction of Ethers.
Class 3. Esters --- Inorganic and Organic Esters; Haloalkane Formation from Alcohols via Inorganic Esters; Reaction of Organic Esters (Hydrolysis, Lactones into Open Chain Esters, Esters into Amides and Alcohols, Reduction).
Class 4. Acyl Halide --- Reactivity of Carbonyl Compounds (Leaving Ability of Leaving Groups); Reaction of Acyl Halides (Conversion into Carboxylic acid, Anhydride, Ester, Amide, Ketone, Aldehyde, and Phenylalkanone).
Class 5. Aldehydes and Ketones --- Preparations of Aldehydes and Ketones (Oxidation of Alcohols, Ozonolysis of Alkenes, Hydration of Alkynes; Friedel-Grafts Acylation)
Class 6. Reactions of Aldehydes and Ketones --- Grignard Reaction; Hydration (in acid/base); Acetalization/Deacetalization; Thioacetalization/Dethioacetalization/Desulfurization.
Class 7. Reactions of Aldehydes and Ketones --- Conversions into Cyanohydrin; Wittig Reaction; Baeyer-Villiger Oxidation; Conversion into Imine, Oxime, and Hydrazone; Reduction of Acyl Compounds into Alkanes.
Class 8. Assessment of the Classes 1-7 with Practice Problems.
Class 9. Enols and Enolates --- Reactivity and Reaction Trends of Carbonyl Compounds in Acid and Base
Class 10. Reactivities of Formaldehyde, Aldehydes, and Ketones and Their Reactions --- Reactions with Amines (into Imine, Iminium, and Enamine) and Reaction Comparison; Mannich Reaction.
Class 11. Reactions of Conjugated Aldehydes, Ketones, --- Preparation of Conjugated Carbonyl Compounds; 1,2-addition versus 1,4-addition; Soft and Hard Base Nucleophiles; Michael Additions; Robinson Annulation.
Class 12. Carboxylic Acids --- Preparation of Carboxylic acids (Alcoholysis, Hydrolysis, Over Oxidation of Primary Alcohols, Reduction of CO2, Conversion of Nitrile into Carboxylic Acid).
Class 13. Reactions of Carboxylic Acids --- Hell-Volhard-Zelinsky Bromination; Acyl Chloride Formation; Anhydride Formation; Decarboxylation.
Class 14. Intermolecular/Intramolecular Cross Condensations --- Aldol Condensation; Claisen Condensation; Retro-Claisen Condensation; Dieckmann Condensation.
Class 15. Assessment of Overall Classes (1-14) with Practice Problems.

●Textbook

Organic Chemistry: Structure and Function (Eighth Edition), Peter K. Vollhardt and Neil Schore, (W. H. Freeman and Company), New York, 2018, Chapters 8-9, and 17-20.

●Additional Reading

Organic Chemistry (second edition), Jonathan Clayden, Nick Greeves, and Stuart Warren (Oxford University Press), 2012 ISBN-10:0199270295.

●Grade Assessment

Examination [total 70%: midterm (30%) and final (40%)] and Assessment of Homework and Attendances (30%): S(x90), A(90>x80), B(80>x70), C(70>x60), and F(60>x) for the students who entered earlier than 2020; A+(95), A(95>xx80), B(80>x70), C(70>x65), C-(65>x60), and F(60x) for the students who entered in 2020 or later than 2020. The assessment methods will be reconsidered due to the change of the pandemic condition.

●Notes

Submission of "Course Withdrawal Request Form is necessary to withdraw the course. The student needs to contact the course instructor when the student wants to withdraw from the course.
In the cases of any unavoidable reasons such as sickness, accident, or no attendance school, the student may get a grade of 'Absent' through the judgment of the course instructor and the student when the student submits a 'Course Withdrawal Request Form' to receive the 'Absent' grade. No submission of sickness/absence reports and lack of attendance score will result in an 'F' grade: It is for the protection of other attendances in the corresponding course from the frequent absences of the specific/uncertain student(s).
This assessment can be reconsidered within pandemic conditions where the attendance can be replaced with the submission of assignments.

●Contacting Faculty

Communication through emails (instructor's e-mail: jyshin321(at)gamil.com) is available. Participants can have lecture material for each class through NUCT. Sudden questions will be given to students during lectures to provide substantial feedback.
Students are recommended to prepare each lecture by reading the corresponding chapters in the textbook and to review it by solving the related homework questions. Each assignment is due by the start of the next class. Late or no submission of the assignment is the deduction point of the grade.

Quantum Chemistry II (2.0credits) (量子化学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	PHUNG Quan manh Associate Professor

●Course Purpose

The purpose of this course is to employ the principles of quantum mechanics to study chemical bonding and molecular structure.By the end of this course, students should be equipped with knowledge and skills concerning the following:1) Understand the electronic structure of atoms and molecules2) Understand the electronic spectroscopy of diatomic and polyatomic molecules3) Perform simple calculations using computational chemistry software4) Apply group theory to study molecules

●Prerequisite Subjects

Fundamentals of Chemistry I and II, Fundamentals of Physics I to IV, Calculus I and II, Linear Algebra I and II, Quantum Chemistry I, or permission of the instructor

●Course Topics

1 Many-Electron Atoms (Ch. 10)2 Quantum States for Many-Electron Atoms and Atomic Spectroscopy 1 (Ch. 11)3 Quantum States for Many-Electron Atoms and Atomic Spectroscopy 2 (Ch. 11)4 The Chemical Bond in Diatomic Molecules 1 (Ch. 12)5 The Chemical Bond in Diatomic Molecules 2 (Ch. 12)6 Review and Midterm evaluation7 Molecular Structure and Energy Levels for Polyatomic Molecules 1 (Ch. 13)8 Molecular Structure and Energy Levels for Polyatomic Molecules 2 (Ch. 13)9 Electronic Spectroscopy 1 (Ch. 14)10 Electronic Spectroscopy 2 (Ch. 14)11 Molecular Symmetry 1 (Ch. 16)12 Molecular Symmetry 2 (Ch. 16)13 Computational Chemistry - Hand-on class 114 Computational Chemistry - Hand-on class 215 Review and Final evaluationStudents will be assigned exercises from each chapter of the textbook.

●Textbook

T. Engel: Quantum Chemistry and Spectroscopy, 3rd Ed. (International edition), Pearson, 2013

●Additional Reading

David W. Ball, Physical Chemistry, 2nd Ed., Cengage Learning, 2015.D. A. McQuarrie and J. D. Simon, Physical Chemistry: A Molecular Approach, University Science Books, 1997.P. Atkins, J. de Paula, and J. Keeler: Atkins' Physical Chemistry, 11th Ed. Oxford University Press, 2018.

●Grade Assessment

Students will be evaluated based on one midterm exam (25% weight), one final exam (comprehensive, 45%weight), and homework (30% weight). Homework will be given at the end of each class. Homework must be submitted before the next class starts. The penalty for homework submitted late should be 10% of the maximum mark per day late. Both midterm and final exams will be written.Grade evaluation will be according to the GPA System at Nagoya University.Students who enrolled AY2020 and onward: "A+": 100-95%, "A": 95-80%, "B": 80-70%, "C": 70-65%, "C-": 65-60%, "F": 60-0%.Students who enrolled before AY2020: "S": 100-90%, "A": 90-80%, "B": 80-70%, "C": 70-60%, "F": 60-0%.To receive a passing grade, a score of at least 60% is required.The course will be graded "Fail (F)" if less than 60% of the points are obtained. The course will be graded as "Absent (W)" as stated in "Conditions for Course Withdrawal".

●Notes

Face-to-face and real-time online lectures combined. The records of the lectures will be provided on Microsoft Teams.

●Contacting Faculty

Phone: 789-2480E-mail: pbutko@chem.nagoya-u.ac.jp

Earth and Planetary Science (2.0credits) (地球惑星科学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Marc HUMBLET A. Designated Associate Professor

●Course Purpose

In this course students will learn about the characteristics of the planets and other components of our solar system (orbital parameters, atmospheric conditions, internal structure and composition, geomorphology, geological activity).We will use the knowledge of our own planet Earth as a reference to understand processes occurring elsewhere.During the past fifty years, various spacecrafts and exploration vehicles have been used to considerably expand our knowledge of the solar system and send back to Earth ever more detailed pictures of distant worlds. The course will review the different means of space exploration and use abundant data acquired by past and ongoing missions to illustrate the characteristics of the planets. A recurrent topic throughout the course will be the fascinating question of the existence of extraterrestrial life and its detection. We will also discuss the future of space exploration.

●Prerequisite Subjects

This course focuses on the geology of planets and moons, and therefore it is linked to Earth Science-related courses.

●Course Topics

1. A brief history of astronomy2. Introduction to the Solar System3. Space exploration4. The Earth-Moon system5. Mercury6. Venus7. Mars8. Jupiter9. Saturn10. Uranus, Neptune, and TNOs

●Textbook

There is no required textbook for this course. Please refer to the recommended reading list below for interestingbooks related to the course content.

●Additional Reading

Faure, G. & Mensing, T.M. (2007). Introduction to Planetary Science: The geological perspective. Springer, 546 pages.Lang, K.R. (2011). The Cambridge Guide to the Solar System. 2nd edition, Cambridge University Press, 502 pages

●Grade Assessment

Two quizzes: 20% (10% each)Two short reports: 20% (10% each)Oral presentation: 15%Written essay: 45%Students who enrolled in 2020 will be graded using the six-step A+, A, B, C, C-, and F grade evaluation system (A+:100-95%, A: 94-80%, B: 79-70%, C: 69-65%, C-: 64-60%, F: 59 % or less).Students who enrolled in 2019 or before will be graded following the five-step S-A-B-C-F grade evaluation system (S:90-100%, A: 80-89%, B: 70-79%, C:60-69%, F: 59-0%).

●Notes

●Contacting Faculty

Phone: 052-789-3037 / E-mail: humblet.marc@f.mbox.nagoya-u.ac.jp

Chemistry of Inorganic Materials I (2.0credits) (無機材料化学1)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

The purpose of this course is to understand the chemical and physical properties of various inorganic materials, their
functions, and their applications.

●Prerequisite Subjects

Inorganic Chemistry I, Fundamentals in Chemistry I + II

●Course Topics

Solid State Chemistry
crystal structure
glass
defect
phase diagram
synthesis
bond
It is desirable to read a textbook or reference materials before a class

●Textbook

• Solid State Chemistry and its Applications (2nd Edition, Student Edition), Anthony R. West; Wiley 2014

●Additional Reading

Carter, Norton, "Ceramic Materials: Science and Engineering", Springer, 2nd Edition, ISBN 978-1-4614-3522-8

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system):
TOTAL 100% = 100 pts
Grades: "S" = 100 - 90% (> 90 pts), "A" = 89 - 80% (9 - 80 pts), "B" = 79 - 70% (79 - 70 pts), "C" = 69 - 60% (69 - 60
pts), "F" = 59 - 0% (< 60 pts)
Face to face classes: Activity, homework: 10%, intermediate exam: 30%, final exam (comprehensive): 60%
On-line classes: Reports: 65%, final exam (on-line): 35% The final exam is mandatory!
Grades are final and calculated on the basis of the performances during class (reports in case of on-line classes) and
in the two exams (one final exam in case of on-line classes) only. There will be no possibility to improve a grade after
the final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasons
can ask the instructor.

●Notes

●Contacting Faculty

Either after the classes or during the office hours/by email (to be announced)
E-mail: gsamjeske@chem.nagoya-u.ac.jp

Quantum Chemistry III (2.0credits) (量子化学３)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Kazuhiro FUJIMOTO Designated Associate Professor

●Course Purpose

The accurate description of the electronic structure of large molecules is an important topic in the field of quantum chemistry, and is required for the accurate understanding of chemical phenomena. In this class, theoretical concepts for large-scale calculations will be covered.

By the end of this course, students should be equipped with knowledge concerning the following:
1. Understand and explain electronic-structure theory.
2. Understand and explain molecular mechanics techniques.
3. Explain characteristics and technical issues of quantum chemical calculations.

●Prerequisite Subjects

Quantum Chemistry I & II

●Course Topics

1. Born-Oppenheimer approximation
2. LCAO-MO theory: Hartree-Fock theory
3. Electron correlation problem
4. Basis sets in quantum chemical calculations
5. Intermolecular interactions
6. Molecular mechanics
7. How to treat a large number of particles (QM/MM, FMO, and DC)

●Textbook

Handouts will be distributed in each class.

●Additional Reading

Modern Quantum Chemistry: Introduction to Advanced Electronic Structure Theory (A. Szabo and N.S. Ostlund), Dover Publications, Inc.

●Grade Assessment

Final examination

●Notes

●Contacting Faculty

Earth Environmental Science (2.0credits) (地球環境科学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Marc HUMBLET A. Designated Associate Professor

●Course Purpose

Never before have had humans such a profound impact on the environment. The world population exceeds 7 billion and is growing steadily. Industrial and technological needs for energy and mineral resources are increasing every year. This course aims to review and discuss how humanity is changing the environment. More specifically, the course examines how human activities alter major biogeochemical cycles, and explores past climate change and the relationships between human activities and climate today. Students also learn about the nature and usefulness of geological resources and the environmental threats posed by their extraction and exploitation. The course not only aims to develop a scientific knowledge of important environmental issues, but also to promote the critical evaluation of information sources and the exchange of opinions in class.By the end of the course, students should be able to understand and explain the subjects covered in class. Students will also be required to search information on topics of their choice and relevant to the course content, analyze the information they have found, and present and discuss their findings in class.

●Prerequisite Subjects

There is no prerequisite for this course.

●Course Topics

1. Introduction2. Environmental Earth Sciences: general concepts3. Earth cycles 1: Nitrogen cycle4. Earth cycles 2: Phosphorus cycle5. Earth cycles 3: Water cycle6. Earth cycles 4: Carbon cycle7. Past, present, future climate change8. Geological Resources: Energy, Rocks, and MineralsTwo quizzes aim to evaluate students' understanding of the course content. In addition, students should fulfill the following assignments: (1) two short presentations on current news related to environmental sciences, (2) an essay/review paper, and (3) an oral presentationIt is desirable to read a textbook or reference materials before a class

●Textbook

There is no required textbook for this course. Please refer to the recommended reading list below for interesting books related to the course content.

●Additional Reading

Anderson, D.E., Goudie, A.S., and Parker, A.G., 2013. Global environments through the Quaternary: exploring environmental changes. Second edition, Oxford University Press, 406 pages.Schlesinger, W.H. and Bernhardt, E.S., 2013. Biogeochemistry: an analysis of global change. Third edition, Elsevier, 672 pages.Ruddiman, W.F., 2013. Earth's climate: past and future. Third edition, Freeman, 464 pages.Craig, J.R., Vaughan, D.J., Skinner, B.J., 2011. Earth resources and the environment. Fourth edition, Pearson, 508 pages.NB: It is not necessary to purchase these references to succeed the quizzes and complete the course assignments.

●Grade Assessment

Students will be graded following the five-step S-A-B-C-F grade evaluation system.S: 90-100%, A: 80-89%, B: 70-79%, C:60-69%, F: 59-0%Two quizzes: 20% (10% each)Two short reports: 20% (10% each)Oral presentation: 20%Written essay: 40%An "Absent (W)" grade is given to students who officially withdraw from the class by the end of May and to students who have withdrawn from the class or an exceptional reason (e.g., illness, accident...). A "Fail (F)" grade is given to students who have not withdrawn from the course and whose final grade is less than 60%.NB: NUPACE students should check the deadline set by the NUPACE program for course withdrawal.

●Notes

Due to the current COVID-19 pandemic, the course may be given entirely online or consist of both online and in-class lectures depending on the number and location of students attending and the specific measures taken by Nagoya University and Aichi Prefecture to slow the spread of infections.Live lectures will be organized (in class or online or both). Online lectures will be recorder and video files will be uploaded on NUSS. PPT slides of the lectures are uploaded every week on NUCT.

●Contacting Faculty

Office: Graduate School of Environmental StudiesDepartment of Earth and Planetary Sciences E516 Phone: 789-3037E-mail: humblet.marc@f.mbox.nagoya-u.ac.jp

Chemistry and Biotechnology Laboratory 1 (3.0credits) (化学生命工学実験１)

Course Type	Basic Specialized Courses
Class Format	Experiment
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

In order to cultivate academic skills, qualities, and abilities to develop engineering, it is necessary to acquire various experimental knowledge and operations. The aim of this experiment is to acquire basic experimental knowledge and operations in analytical chemistry and physical chemistry with backgrounds in subjects of chemical reactions, chemical equilibrium, thermodynamics, reaction kinetics, spectroscopy, electrochemistry, and computational chemistry. It also enhances the development of the ability to organize and analyze data and create reports.

By the end of this experiment, students should be able to do the following:

1. Acquire experimental operation on fundamentals of analytical chemistry and physical chemistry.
2. Deepen the understanding of chemical reaction, chemical equilibrium, thermodynamics, reaction kinetics, spectroscopy, electrochemistry, computational chemistry, etc.
3. Design experimental plans, organize and analyze data, and discuss results.
4. Create a logical report.
5. Acquire the foundation of applied and comprehensive skills required for future professional research.

●Prerequisite Subjects

Elemental Chemistry I & II, Analytical Chemistry 1 & 2 with Exercises, Chemical Kinetics with Exercises, Thermodynamics 1 & 2 with Exercises, Structural Chemistry and Electrochemistry with Exercises, Quantum Chemistry 1 & 2 with Exercises, Safety in Laboratory

●Course Topics

Experiment I. Titration experiment
Experiment II. Analytical chemistry experiment, Instrument analysis experiment, Physical chemistry experiment

The following themes are set as analytical chemistry experiment, instrumental analysis experiment, and physical chemistry experiment.

1. Electron spectrum, 2. Vibrational spectrum, 3. Separation analysis, 4. Electrochemistry, 5. X-ray diffraction , 6. Thermal analysis

Read the experimental guideline before each experiment. In addition, a report task is assigned for each experiment. After organizing, analyzing, and considering the experimental results, submit it as a report by the submission deadline.

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Instructions will be given as needed.

●Grade Assessment

Grading will be decided based on the approach to the experiment (positiveness, activeness), logical thinking / judgment for the results, experimental skills and reports. Credits will be awarded to those students who

score 60 or more out of 100 points. Grades are as follows:

Enrollees after 2020
A+: 100-95A: 94-80B: 79-70C: 69-65C-: 64-60F: 59-0

Enrollees before 2019
S: 100-90A: 89-80B: 79-70C: 69-60F: 59-0

●Notes

Although the classes will generally be conducted face-to-face, the style of the class may changed into online in certain circumstances. The change of the style will be announced in NUCT.

It is assumed that you have earned credits for Safety in Laboratory.

●Contacting Faculty

Professors and teaching assistants will answer the questions. Besides, students can make an appointment with the lecturers via email or NUCT.

Contact address:
Eisuke Yamamoto (e-yamamoto[at]imass.nagoya-u.ac.jp)
Tomoshige Fujino (fujino[at]chembio.nagoya-u.ac.jp)
Taisuke Shimada (shimada[at]chembio.nagoya-u.ac.jp)

Chemistry and Biotechnology Laboratory II (3.0credits) (化学生命工学実験２)

Course Type	Basic Specialized Courses
Class Format	Experiment
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

This laboratory class aims to learn fundamental experimental procedures on organic chemistry and biotechnology.

●Prerequisite Subjects

Elemental Chemistry I & II, Organic chemistry 1 ~ 4 with Exercises, Biochemistry 1~ 3 with Exercises, Safety in Laboratory

●Course Topics

* Safety in chemical laboratory
* Basic organic chemistry

1.spectroscopy in organic chemistry, 2. separation and synthesis of olefin compounds and reactivity of olefinic bond, 3. separation and purification of organic compounds, 4. identification of unknown compounds

* Basic Biotechnology

1. bacterial culture, 2. enzyme reaction

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Vollhardt/Schore Organic Chemistry Structure and Function; K. P. C. Vollhardt, N. E. Schore
Biochemistry EIGHTH EDITION; J. M. Berg, J. L. Tymoczko, G.J. Gatto,Jr., L. Stryer

●Grade Assessment

Evaluated by implementation of experiments and experimental reports

Credits will be awarded to those students who score 60 or more.
Grades are as follows:
A+:100-95, A:94-80, B:79-70, C:69-65, C-:64-60, F:59-0.

●Notes

It is assumed that you have earned credits for Safety in Laboratory.

●Contacting Faculty

Professors and teaching assistants will answer the questions.

Inorganic Chemistry III (2.0credits) (無機化学３)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

Inorganic chemistry III is the final part of a three-semester course in inorganic chemistry consisting of parts I, II, and III. Aim of the three-semester course is to present principles and fundamentals of inorganic chemistry, to introduce chemical reactions and to show examples of the role of inorganic chemistry in the industry, environment and every day lives.At the end of the complete course (Inorganic Chemistry I, II, III), students should have learned a robust foundation in physical inorganic principles and also applications of the subject to catalysis and industrial processes.

●Prerequisite Subjects

Fundamentals of Chemistry I and II, Analytical Chemistry, Inorganic Chemistry I & II

●Course Topics

The course Inorganic Chemistry III will be structured as follows: (chapter refer to the used textbook, Housecroft)Class 1: d-block metal chemistry/general considerations (chapter 19)Class 2: d-block metal chemistry/coordination complexes (chapter 20)Class 3: d-block metal chemistry/coordination complexes (Part II)Class 4: d-block metal chemistry/the first row metals (chapter 21)Class 5: d-block metal chemistry/the first row metals (Part II)Class 6: d-block metal chemistry/the heavier metals (chapter 22)Intermediate examClass 7: d-block metal chemistry/the heavier metals (Part II)Class 8: Organometallic compounds of s- and p-block metals (chapter 23)Class 9: Organometallic compounds of d-block metals (chapter 24)Class 10: Catalysis & some industrial processes (chapter 25)Class 11: d-block metal complexes/reaction mechanism (chapter 26)Class 12: d-block metal complexes/reaction mechanisms (Part II)Class 13: f-block metals/lanthanoids & actinides (chapter 27)Final exam (comprehensive)Depending on the situation a shift of topics between classes might happen

●Textbook

Catherine E. Housecroft, Alan G. Sharpe; INORGANIC CHEMISTRY, 5TH EDITION; PEARSON - PRENTICE HALL

●Additional Reading

Pfennig, Brian William: "Principles of Inorganic Chemistry", 2015, John Wiley & Sons, Inc., ISBN 978-1-118-85910-0

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system) or since AY2020 (6 letter system):maximum TOTAL 100% (= 100 pts)Homework submission: 10% (= 10 points)Intermediate exam: 40% (= 40 pts)Final exam (comprehensive): 50% (= 50 pts)The intermediate and final exam are mandatory!Grades are final and calculated on the basis of the performances during class (homework submission) and in the two exams only. There will be no possibility to improve a grade after the final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasons can ask the instructor.The course will be graded "F" (failed) if less than 60% of the total points were obtained. The course will be graded as "absent" ("A" or "W") if withdrawal was applied before the intermediate exam, as stated in "course withdrawal"

●Notes

Face-to-Face class and remote class (on-demand class) combined.

●Contacting Faculty

Either after the classes or during the office hours/by email (to be announced)E-mail: gsamjeske@chem.nagoya-u.ac.jpQuestions should be asked by email (NOT the messaging system) or by making an appointment for a ZOOM or MS Teams meeting

Biophysics (2.0credits) (生物物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	2 Spring Semester
Elective/Compulsory	Elective
Lecturer	TAMA Florence Muriel Professor

●Course Purpose

This course introduces the basics of biophysics, in which biological phenomena are described in terms of physics language to the students taking this course.The class will highlight the role of physics, chemistry, and computer science in the study of biological molecules. The students will familiarize themselves with protein structures and methods to study these as well as computer tools to visualize and analyze those protein structures

●Prerequisite Subjects

There is no prerequisites.

●Course Topics

The course will cover structure of biomolecules (proteins, nucleic acids, membranes) before introducing biophysical techniques (experimental and computational) to characterize function/dynamics/folding of these biomolecules.

●Textbook

None

●Additional Reading

Ask the instructor

●Grade Assessment

The final grade will be based on a mid-term exam, student presentations, assignments and attendance.Absent: submission of Course Withdrawal Request Form required,Fail: total accumulated score of less than 60%.

●Notes

The class will be face-to-face or conducted remotely - information will be available on the NUCT website before class star

●Contacting Faculty

By email: florence.tama@nagoya-u.jpQuestion to teachers should be asked using the NUCT function "Message"

Organic Chemistry V (2.0credits) (有機化学５)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Jiyoung SHIN Professor

●Course Purpose

This course was established to learn spectroscopic analysis of organic molecules and how to interpret spectral data. The course begins with theoretical/fundamental knowledge on the chromatographic and spectroscopic techniques (GC, HPLC, NMR, UV, IR, Raman, Mass, and so on) and continues to assignments of organic molecular structures with Spectra-type problems. Furthermore, it covers problem-solving regarding organic reactions to reinforce students' understanding of molecular structures/reactivities. The participants are expected to solve the progressive problems sequentially.

●Prerequisite Subjects

Organic chemistry I and II

●Course Topics

Class 1 & 2. Purification/Separation of Organic Molecules --- Chromatographic Principles and Methods; Gas Chromatography and Liquid Chromatography.
Class 3. Principle of Mass Spectrometry --- Ionization Techniques (EI, CI, FAB, ESI, APCI); Ion Separation Techniques (Magnetic Sector, Quadrupole, Ion Trap, TOF, FT); Fragmentations (Heterolytic and Homolytic Cleavages); Mass Patterns of Isotopes.
Class 4. Assignment of Mass Spectra --- Guidelines for predicting prominent EI Spectral peaks for Alcohols, Ethers, Ketones, Carboxylic Acids, Esters, Amines, and Aliphatic Sulfides.
Class 5. Vibration Spectroscopy --- FT-IR Absorption Spectroscopy and Raman Spectroscopy; Rayleigh and Stokes/Antistokes lines; Molecular Vibrational Motions; Assignment of IR Spectra of Organic Molecules.
Class 6. UV-Vis Absorption Spectroscopy --- Wavenumber & Wavelength; Map of UV/vis absorption spectrometer (Monochromator and Diode-type); Beer-Lambert Law and Molecular Absorption Coefficient; Electron Transitions Involving p/s/n Electrons, Charge-Transfer Electrons, and d/f Electrons; pai-Conjugated Systems; Absorption in the Gaseous States.
Class 7. Emission Spectroscopy --- Jablonski Energy Diagram and Electron Spin States; Fluorescence and Phosphorescence; Stokes Shift; Instrumental Outlines; Lifetime Decay Profiles; Quantum Yield; Steady State & Transient Absorption Spectroscopy.
Class 8 & 9. Fundamental Principle of NMR Spectroscopy --- NMR Active/Inactive Nuclei; External Magnetic Field, Larmor Frequency, Resonance Feature, Saturation, and Net Magnetization, 90 Degree Pulse, Spin-Spin Decay, FT of FID, Structure of NMR Machine, Chemical Shift, Shielding/Deshielding, J coupling; Karplus Curve for Vicinal Couplings and Cis/Trans Correlation; Shimming; Probe Tuning; Locking; Important Parameters for NMR Analysis.
Class 10. Characterization of Molecular Structure and Assignment of NMR Spectra, and Advanced Techniques --- Peak Assignments of NMR Spectra of Example Organic Compounds (1H, COSY, NOESY, ROESY, APT 13C, HSQC, HMBC, TOCSY NMR Spectra); NMR Spectra of Paramagnetic Metal Complex.
Class 11. Students' Presentation and Discussion (Assessment of the Classes 1-10).
Classes 12-14. Problem-Solving Process for Structure Determination and the Corresponding Organic Reaction.
Class 15. Course Assessment and Solution Steps.

●Textbook

- Organic Chemistry: Structure and Function (Eighth Edition), Peter K. Vollhardt and Neil Schore, (W. H. Freeman and Company), New York, 2018, Chapters 10-21.
- Handout materials of the lectures will be given in the respective classes.

●Additional Reading

1. Spectrometric Identification of Organic Compounds (8th Edition), Robert M. Silverstein, Francis X. Webster, David J. Kiemle, and David L. Bryce, (Wiley), 2012, ISBN-10:0470616377.
2. Spectroscopic Methods in Organic Chemistry (2nd Edition) Manfred Hesse, Herbert Meier, Bernd Zeeh (Translated by Richard Dunmur, Martin Myrray), Thieme, New York, ISBN 978-1-58890-488-1.

●Grade Assessment

Examination [total 70%: midterm (30%) and final (40%)] and Assessment of Homework and attendances (30%): S(x90), A(90>x80), B(80>x70), C(70>x60), and F(60>x) for the students who entered earlier than 2020; A+(95), A(95>xx80), B(80>x70), C(70>x65), C-(65>x60), and F(60x) for the students who entered in 2020 or later than 2020.

●Notes

Submission of the "Course Withdrawal Request Form is necessary to withdraw the course. The student needs to contact the course instructor when the student wants to withdraw from the course. In the cases of any unavoidable reasons such as sickness, accident, or no attendance school, the student may get a grade of 'Absent' through the judgment of the course instructor and the student when the student submits a 'Course Withdrawal Request Form' to receive the 'Absent' grade. No submission of sickness/absence reports and lack of attendance score will result in an 'F' grade: It is for the protection of other attendances in the corresponding course from the frequent absences of the specific/uncertain student(s).
The course schedule can be reconsidered within pandemic conditions.

●Contacting Faculty

Students can communicate with the course instructor face-to-face, either in the class or through the appointment. Communication through emails is also available (instructor's e-mail: jyshin321(at)gamil.com). Lecture material for each class will be provided through NUCT. Students are recommended to review the lectures by solving the related homework questions. Each assignment is due by the start of the next class if it is not specially announced. Sudden questions can be given to students during lectures to provide substantial feedback.

Polymer Chemistry (2.0credits) (高分子化学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Faculty of Chemistry

●Course Purpose

The purpose of this course is to learn basics of polymer science. The course begins with basic concepts of polymer, proceeds next to polymerization and synthesis of various polymers, and moves then to characterization, structures, properties, and functions of polymers, and biopolymers.
Upon taking this course, you aim to learn basics of polymer science, such as what polymers are, how to make polymers, how to characterize polymer properties, how properties are affected by polymer structures, how to design functional polymers, and how biopolymers are different from synthetic polymers. You will get basic knowledge on polymer science first and then abilities to apply the basic knowledge to creating new polymer materials.

●Prerequisite Subjects

Fundamentals of Chemistry I, II, Organic Chemistry I, II, Physical Chemistry I, II, Analytical Chemistry

●Course Topics

1. Introduction to Polymer
2. Step-Growth Polymerization
3. Free-Radical Addition Polymerization
4. Ionic Polymerization
5. Linear Copolymers and Other Architectures
6. Polymer Stereochemistry
7. Polymerization Reactions Initiated by Metal Catalysts and Transfer Reactions
8. Polymers in Solution
9. Polymer Characterization – Molar Masses
10. Polymer Characterization – Chain Dimensions, Structures, and Morphology
11. The Crystalline State and Partially Ordered Structures
12. The Glassy State and Glass Transition
13. Rheology and Mechanical Properties
14. The Elastomeric State
15. Structure-Property Relations
16. DNA and RNA that Encode Genetic Information as their Sequences
17. Higher-Order Structures of Polypeptides and Protein

Prior to taking each class, read the corresponding part of the textbook. After taking the class, solve the problems in the textbook by yourself. During each class, solve the quizzes.

●Textbook

Polymers: Chemistry and Physics of Modern Materials (J. M. G. Cowie and Valeria Arrighi), 3rd Edition; CRC Press

●Additional Reading

Principles of Polymerization (G. Odian), 4th Edition, Wiley-Interscience

●Grade Assessment

The grading is based on quizzes during classes.
Credits will be awarded to those students who understand basics on synthetic and bio-based polymers, polymerization, polymer characterization, structures, properties, and functions. Advanced understandings will be considered.
A minimum average score of 60 or higher out of 100 should be obtained to pass this course.

Enrollees after 2020
100-95 : A+94-80 : A79-70 : B69-65 : C64-60 : C-59-0 : F
Enrollees before 2019
100-90 : S89-80 : A79-70 : B69-60 : C59-0 : F

●Notes

●Contacting Faculty

Students can communicate with their lecturers after lectures.

Chemical Physics (2.0credits) (化学物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	YukoOKAMOTO Professor

●Course Purpose

The purpose of this course is to learn about the statistical thermodynamics which can describe the behaviors ofmolecules in physical, chemical, and biological systems.

●Prerequisite Subjects

Biophysics, Statistical Physics I

●Course Topics

1. Mathematical Tools2. Extremum Principles3. Heat, Work, and Energy4. Entropy and the Boltzmann Law5. Thermodynamic Driving Forces6. The Logic of Thermodynamics7. Laboratory Conditions and Free Energy8. Maxwell's Relations and Mixtures9. The Boltzmann Distribution Law10. The Statistical Mechanics of Simple Gases and Solids11. Temperature and Heat Capacity12. Chemical EquilibriaIt is desirable to read a textbook or reference materials before a class

●Textbook

K.A. Dill and S. Bromberg, "Molecular Driving Forces" 2nd ed. (Garland Science).

●Additional Reading

F. Reif, "Fundamentals of Statistical and Thermal Physics" (McGraw-Hill).

●Grade Assessment

Attendance: 10 %, Homework Sets: 20 %, Exams: 70 %The “Absent (W)” grade is given to those who did not take exams.The "Fail" grade is given to those who did very badly with respect to the above evaluation criteria: attendance,homework sets, and exams.

●Notes

●Contacting Faculty

Email: okamoto@tb.phys.nagoya-u.ac.jp

Organic Chemistry IV (2.0credits) (有機化学４)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Jiyoung SHIN Professor

●Course Purpose

This course was designed to promote an understanding of advanced organic chemistry and to help students build a logical framework for understanding the hybrid knowledge. The course begins with condensation reactions of carbonyl and amine compounds and moves on to various reactions comprising migration steps. It also continues heterocyclic chemistry and organometallic chemistry, which are rapidly-expanding fields. Organometallic compounds that incorporate the carbon-metal bonds as powerful nucleophiles have been widely used for effective synthetic transformation. Replacement of the first metal by a new one can activate or control the chemical reactions' outcomes.
Based on the knowledge, the participants are expected to conduct how to perceive appropriate answers to challenging problems in organic chemistry.

●Prerequisite Subjects

Fundamental Chemistry I and II, and Organic Chemistry I, II, and III

●Course Topics

Class 1. The reaction of Carbonyl Compounds --- Formations, Condensations, Reaction of Conjugated Carbonyl Compounds; Protection of Acyl Group; Decarboxylation of beta-Carbonyl Carboxylic Acid.
Class 2. Amines --- Preparations of Amines (by Subsequent Alkylation, Reduction of Nitrile, Reduction of Imine, Reduction of Azide, Hydrogenation of Amide, Hofmann Rearrangement, Mannich Reaction, Gabriel Phthalimide Synthesis).
Class 3. Amines --- Reactions of Amines (Alkylation, Acylation, Hoffmann Elimination).
Class 4. Six-Membered Aromatic Heterocycles (Pyridine, Pyridazine, Pyrimidine, Pyrazine, Pyridine Derivatives, and PCC) --- Electron Configuration and Reactivity of Pyridine; Preparation of Pyridine; Pyrylium ion & Pyrones; Tautomerization of Hydroxypyridine into pyridone; Preparation of Pyridone.
Class 5. Preparation and Nucleophilic/Electrophilic Substitutions of Pyridine N-oxides; Reactivity of Pyridine N-Oxide and Pyridine with Electron Donating Groups in Electrophilic Substitutions.
Class 6. Five membered Aromatic Heterocycles (Pyrrole, Pyrazole, Imidazole, and Triazole) --- Electron Configuration of Pyrrole and Reactivity for Electrophilic Substitution; Electrophilic Substitutions of pyrrole (Bromination, Acylation, Mannich Reaction, Nitration, Polymerization); Preparation of Pyrrole.
Class 7. Five membered Aromatic Heterocycles --- Reaction of Pyrrole (Decarboxylation, Acid-Catalyzed Intermolecular Condensation, Porphyrin Synthesis); Reaction of Thiophene (Friedel Crafts Acylation of 2-Methyl Thiophene); Reaction of Furane (Bromination, Acetal Formation, Ring Opening).
Class 8. Fused Heterocycles (Quinoline, Isoquinoline, and Indol) --- Substitution Trends of Quinoline and Isoquinoline (Electrophilic and Nucleophilic Reactions); Preparation of Quinoline; Substitution Trends of Indol; Preparation of Indol.
Class 9. Assessment of Classes 1-8 (Problems and Solutions).
Class 10. Ring Formation from pai-Conjugation – Electrocyclizations (Thermal & Photochemical Reactions); Cycloadditions (Diels-Alder Reactions); Sigmatropic Rearrangements (Cope Rearrangement, Claisen (General, Johson-Claisen, Eschenmoser-Claisen, Ireland-Claisen) Rearrangements, Sulfoxide Formation through [2,3] Sigmatropic Rearrangement).
Class 11. Ring Expansion or Ring Shrinking Reactions --- Baeyer Villiger Oxidation; Beckmann Rearrangement; Tiffeneau-Demjanov Rearrangement; Favoskii Rearrangement; Wagner-Meerwein Rearrangement.
Class 12-13. Organotransition Metal Chemistry: Electronegativity Differences and Organometal Reactions; Pd-catalyzed Cross Couplings (Negishi, Kumada, Stille, Suzuki-Miyaura, Sonogashira, Hiyama, Mizoroki-

Heck Cross Couplings).
Class 14. Organotransition Metal Chemistry: Oranometal Catalyzed Metathesis (Grubbs & Schrocks Catalysts and the Cyclic Metathesis); Zigler-Natta Catalysis; Wilkinson Reduction.
Class 15. Assessment of Overall Classes (Final Test and Solution Process).

●Textbook

Organic Chemistry: Structure and Function (Eighth Edition), Peter K. Vollhardt and Neil Schore, (W. H. Freeman and Company), New York, 2018, Chapters 21, 23-26.

●Additional Reading

1. Organic Chemistry (Second edition), Jonathan Clayden, Nick Greeves, and Stuart Warren, Oxford, 2012, Chapters 29-30, and 40.
2. Advanced Organic Chemistry (Part B: Reaction and Synthesis, Fifth Edition), Francis A. Carey, Richard J. Sundberg, Springer, 2007, Chapters 7-8.
3. Organometallic Chemistry (Second Edition), Gary O. Spessard, Gary L. Miessler, Oxford, 2010.

●Grade Assessment

Examination (total 70%: midterm (30%) and final (40%)), Assessment of Homework and Attendances (30%): S(x90), A(90>x80), B(80>x70), C(70>x60), and F(60>x) for the students who entered earlier than 2020; A+(95), A(95>xx80), B(80>x70), C(70>x65), C-(65>x60), and F(60x) for the students who entered in 2020 or later than 2020. The assessment methods will be reconsidered due to the change of the pandemic condition.

●Notes

Submission of the "Course Withdrawal Request Form is necessary to withdraw the course. The student needs to contact the course instructor when the student wants to withdraw from the course. In the cases of any unavoidable reasons such as sickness, accident, or no attendance school, the student may get a grade of 'Absent' through the judgment of the course instructor and the student when the student submits a 'Course Withdrawal Request Form' to receive the 'Absent' grade. No submission of sickness/absence reports and lack of attendance score will result in an 'F' grade: It is for the protection of other attendances in the corresponding course from the frequent absences of the specific/uncertain student(s). Pandemic conditions can reconsider this assessment.

●Contacting Faculty

Students can communicate with the course instructor face-to-face, either in the class or through the appointment. Communication through emails (instructor's e-mail: jyshin321(at)gamil.com) is also available. Students are recommended to prepare each lecture by reading the corresponding chapter in the textbook. Also, Students are recommended to review it by solving the related homework questions. Each assignment is due by the start of the next class if it is not specially announced. Late or no assignment submission is the deduction point of the grade.
This course is a lecture based course. Participants can get lecture material for each class through NUCT. Also, sudden questions will be given to students during lectures to provide substantial feedback.

Chemistry of Inorganic Materials II (2.0credits) (無機材料化学２)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	SAMJESKE Gabor arwed Designated Professor

●Course Purpose

The purpose of this two semester course consisting of Chemistry of Inorganic Materials I & II is to understand the chemical and physical properties of various inorganic materials, their functions, their analysis and their applications.

At the end of the two-part course, students will have gained knowledge of solid-state chemistry enabling them to understand structures, synthesis and analysis of inorganic solid materials.

●Prerequisite Subjects

Fundamentals of Chemistry I & II, Inorganic Chemistry I & II, Chemistry of Inorganic Materials I

●Course Topics

The course Chemistry of Inorganic Materials I will be structured as follows:

Class 1: Phase diagrams (Part II)
Class 2: Phase diagrams (Part III)
Class 3: Crystallography & diffraction techniques
Class 4: Crystallography & diffraction techniques (Part II)
Class 5: Microscopy, spectroscopy & electron microscopy techniques
Class 6: Microscopy, spectroscopy & electron microscopy (Part II)
Intermediate exam
Class 7: Electrical properties
Class 8: Electrical properties (Part II)
Class 9: Electrical properties (Part III)
Class 10: Magnetic properties
Class 11: Magnetic properties (Part II)
Class 12: Optical properties, luminescence & lasers
Class 13: Optical properties, luminescence & lasers (Part II)
Final exam (comprehensive)

Depending on the situation a shift of topics between classes might happen

●Textbook

Solid State Chemistry and its Applications (2nd Edition, Student Edition), Anthony R. West; Wiley 2014

●Additional Reading

Ceramic Materials, Science and Engineering (Second Edition), C. Barry Carter & M. Grant Norton; Springer 2013

●Grade Assessment

Grading will follow the rules for G30 students who have entered NU before AY2020 (5 letter system) or since AY2020 (6 letter system):

maximum TOTAL 100% (= 100 pts)

Homework submission: 10% (= 10 points)
Presentation: 10% (=10 points)
Intermediate exam: 30% (= 30 pts)
Final exam (comprehensive): 50% (= 50 pts)
The presentation and both exams are mandatory

Grades are final and calculated on the basis of the performances during class (homework submission) and in the two exams only. There will be no possibility to improve a grade after the final exam. Students who miss the final exam due to a (documented) illness, injury or other unavoidable reasons can ask the instructor.

●Notes

Face-to-Face class and remote class (on-demand class) combined.

●Contacting Faculty

EEither after the classes or during the office hours/by email (to be announced)

Questions should be asked by email (NOT the messaging system) or by making an appointment for a ZOOM or MS Teams meeting

Computational Chemistry (2.0credits) (計算化学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	YANAI Takeshi Professor

●Course Purpose

Computers and computing technologies are becoming increasingly important as a tool to facilitate complex work and
expand ones' abilities for carrying out chemical studies. In this class, attendees will learn basics of programming for
effectively using computer and write programs in Python language for numerical analysis, chemical calculations, etc.

●Prerequisite Subjects

Quantum Chemistry I

●Course Topics

1. Python programming Tutorial
2. Numpy Tutorial
3. Graph and plotting: Matplotlib
4. Quantum chemistry calculations
5. Potential energy curves
6. Geometry optimization
7. Plotting of molecular orbitals
8. Problem sets

It is desirable to read a textbook or reference materials before a class

●Textbook

There is no designated textbook, but lecture materials will be handed out.

●Additional Reading

Python tutorial: https://docs.python.org/2/tutorial/
Numpy quick tutorial: https://docs.scipy.org/doc/numpy/user/quickstart.html
Matplotlib quick tutorial: https://matplotlib.org/tutorials/introductory/pyplot.html
Hartree-Fock theory:
http://vergil.chemistry.gatech.edu/courses/chem6485/pdf/Hartree-Fock-Intro.pdf
Scikit-learn tutorials: http://scikit-learn.org/stable/tutorial/index.html

●Grade Assessment

Attendance and report on programming
"Absent (W)": if 10% of 90min class is absent in class room.
"Fail (F)": if final report is not handed in.

●Notes

●Contacting Faculty

yanait@chem.nagoya-u.ac.jp

Current Organic and Polymer Chemistry (2.0credits) (先端有機・高分子化学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Faculty of Chemistry

●Course Purpose

The purpose of this course is to present an overview of cutting-edge organic chemistry, and learn important principles and facets of modern chemistry. The course includes sophisticated catalysts and reagents (organic-based and metal-based) for making useful compounds, designer functional organic molecules with various optoelectronic properties, and synthesis of natural products and biologically active complex molecules.

●Prerequisite Subjects

Organic Chemistry 1-5

●Course Topics

1. Organocatalysts for Green Chemistry
2. Chiral Catalysts for Enantioselective Synthesis
3. Transition Metal Catalysts for Unreactive Bond Activation
4. Synthesis of Optoelectronic Materials
5. Synthesis of Natural Products and Biologically Active Compounds

It is desirable to read a textbook or reference materials before a class

●Textbook

The textbook is not specified.

●Additional Reading

Organic Chemistry: Structure and Function 6th ed.
K. Peter C. Vollhardt, Neil E. Schore

●Grade Assessment

Grades will be based on reports.

●Notes

No requirements for attending this course.

●Contacting Faculty

Students can communicate with their lecturers during lectures, office hours, or via email.
Contact: Prof. Hideto ITO <ito.hideto@g.mbox.nagoya-u.ac.jp

Biochemistry IV (2.0credits) (生化学４)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	NADANO Daita Associate Professor

●Course Purpose

This course is aimed at expanding students' knowledge in basics of the gene expression and replication from biochemical aspects, including metabolism, structure and molecular function of DNA, RNA and related proteins. The main goal of this course is for students to understand the structure, synthesis, repair, and recombination of DNA, the synthesis (transcription) and processing of RNA, and the synthesis (translation) and processing of proteins.

●Prerequisite Subjects

Biochemistry I, II and III. Basic knowledge of biology and chemistry

●Course Topics

Part V "Gene expression and replication" of the textbook1. DNA structure2. DNA synthesis3. DNA repair and recombination4. RNA metabolism: transcription and posttranscriptional processing5. Transfer RNA and ribosomes6. Translation and posttranslational processing7. DNA-protein interaction and regulation of gene expressionStudents are requested to review after every lecture and submit assignments indicated by the instructors.

●Textbook

Voet's Principles of Biochemistry, Global edition, Fifth editionVoet D, Voet JG, Pratt CW (John Wiley & Sons)

●Additional Reading

Molecular Biology of the Cell, Alberts B et al. (Garland Science)

●Grade Assessment

Evaluation will be based on examinations at the end of course, and answer/report sheets for Checkpoint at every time of the class.

●Notes

●Contacting Faculty

Office: Bioagricultural Sciences Building A, Room A-528Phone: 052-789-4129E-mail: tmatsuda@agr.nagoya-u.ac.jp

Cell Biology IV (2.0credits) (細胞学４)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Chemistry
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Hideki SHIBATA Associate Professor

●Course Purpose

This course covers advanced topics in molecular cell biology, including application and methods. Students will learn how research on molecular cell biology is achieved with advanced technology in the particular areas of ion transport, membrane traffic, stem cells, biomedicines, live-cell imaging, epithelial cell biology etc.

●Prerequisite Subjects

Basic knowledge on molecular biology

●Course Topics

(I) Ion channels: Electrophysiology, structure and function(II) Membrane traffic: Bio-imaging and fluorescent probes(III) Tissues and stem cells(IV) Epithelial cell structure and communications(IV) ExamReview after each lecture, and work on assignments and examinations in accordance with the instructions of the instructor.

●Textbook

ITBA

●Additional Reading

Essential Cell Biology (5th ed.) Bruce Alberts et al. ; Molecular Biology of the Cell (6th ed.)

●Grade Assessment

Evaluation will be based on in-class participation, assignments, and examinations.

●Notes

●Contacting Faculty

Chemistry and Biotechnology Laboratory 3 (3.0credits) (化学生命工学実験３)

Course Type	Specialized Courses
Class Format	Experiment
Course Name	Chemistry
Starts 1	4 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

This course enhances the development of the student's skill in carrying out organic chemistry and biotechnology experiments. It will help your graduation research in 4th grade (graduation thesis A and B). Through organic chemistry laboratory, you will learn advanced experimental protocols for the synthesis, separation, purification, and identification of organic molecules. Biotechnology laboratory aims to learn advanced experimental procedure.

●Prerequisite Subjects

Elemental Chemistry I & II, Organic chemistry 1 ~ 5, Biochemistry 1, chemistry and biotechnology laboratory 2.

●Course Topics

* Advanced organic chemistry
1-a. Asymmetric synthesis of phenylalanine using chiral phase transfer catalysts
1-b. Derivatization of citronellal
2-a. Cross-coupling reaction with Grignard reagents
2-b. Chemiluminescence with luminol
3. C-C bond formation with enolate anions
4. Lidocaine as a synthetic drug
5. Synthesis of benzene ring via [2+2+2] cycloisomerization of alkynes with ruthenium catalyst

* Advanced biotechnology
1. Elemental Experiments in Recombinant DNA Technology
2. Purification and Analysis of Protein
3a. Fluorescent DNA probe for detection of INDEL
3b. Microchip electrophoresis-based DNA analysis

●Textbook

Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading

Vollhardt/Schore Organic Chemistry Structure and Function, 6th Ed.; K. P. C. Vollhardt, N. E. Schore
Biochemistry EIGHTH EDITION; J. M. Berg, J. L. Tymoczko, G.J. Gatto,Jr., L. Stryer

●Grade Assessment

Grading will be decided based on approach to the experiment (positiveness, activeness), logical thinking / judgment for the results, experimental skills and reports. Credits will be awarded to those students who score 60 or more out of 100 points.

●Notes

It is assumed that you have earned credits for Safety in Laboratory.

●Contacting Faculty

Professors and teaching assistants will answer the questions.

Chemistry and Biotechnology Laboratory 4 (3.0credits) (化学生命工学実験４)

Course Type	Specialized Courses
Class Format	Experiment
Course Name	Chemistry
Starts 1	4 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

In order to cultivate academic skills, qualities, and abilities to develop engineering, it is necessary to acquire various advanced experimental knowledge and operations. The aim of this experiment is to acquire advanced experimental knowledge and operations related to inorganic chemistry, physical chemistry, polymer synthesis chemistry, and polymer physical chemistry. It also enhances the development of the ability to organize and analyze data and create reports.

This experiment consists of two parts; Inorganic/Physical Chemistry Experiment and Polymer Chemistry Experiment. By the end of this experiment, students should be able to do the following:

< Inorganic and physical chemistry experiment>
1. Acquiring basic knowledge on firing process, structural analysis and physical property evaluation of ceramics.
2. Understanding the fabrication process of nanosheets based on solution chemistry and the analysis method of nanomaterials.
3. Acquiring basic knowledge of inorganic and complex chemistry and learning characterization techniques relating to complex.
4. Acquiring basic knowledge of inorganic and analytical chemistry through the synthesis and evaluation of hierarchical porous materials.
5. Acquiring basic knowledges to make an experimental plan, to interpret the results, and to explain the achievements through reports and oral presentations.
6. Understanding the electron energy structure of semiconductors/organic dyes and their photoresponsivity.
7. Understanding the basics of programming on Linux OS through computer experiments on proteins.

< Polymer chemistry experiment>
1. Acquire an understanding of synthesis, separation/purification, and characterization of polymer.
2. Acquire an understanding of the safety experimental operation
3. Acquire knowledge regarding preparation of polymer materials and evaluation method of polymer physical phenomena.
4. Design experimental plans, organize and analyze data, and discuss results.
5. Create a logical report.
6. Deepen the understanding of polymer synthesis chemistry and polymer physical chemistry.

●Prerequisite Subjects

Chemistry and Biotechnology Laboratory 1 ~ 3, Safety in Laboratory, Elemental Chemistry I & II, Chemical Kinetics with Exercises, Thermodynamics 1 & 2 with Exercises, Structural Chemistry and Electrochemistry with Exercises, Quantum Chemistry 1 & 2 with Exercised, Inorganic Chemistry 1 & 2 with Exercises, Chemistry of Inorganic Reaction, Organic Chemistry 1 ~ 5 with Exercises, Fundamentals of Polymer Chemistry, Synthetic Polymer Chemistry

●Course Topics

Advanced experiments on inorganic chemistry, physical chemistry, and polymer chemistry, are carried out, then results of the experiments are discussed and summarized in a report. Presentation is also carried out in inorganic and physical chemistry experiment. Individual experimental topics are as follows.

< Inorganic and physical chemistry experiment>
1. Synthesis and Analysis of Biomedical Ceramics
2. Synthesis and Characterization of Inorganic Nanosheets
3. Syntheses and Characterization of Porous Metal Complexes
4. Synthesis and Characterization of Hierarchically Porous Materials by Sol-gel Method
5. Catalytic Action in Hydrogen Peroxide Decomposition Reaction
6. Fabrication and Characterization of Dye-sensitized Solar Cell
7. Protein Computer Experiment Guidelines.

< Polymer chemistry experiment>
1. Preparation and Characterization of Thermoplastic Elastomers Correlation between the Long-Chain Molecular Structure and the Physical Properties
2. Radical Copolymerization, Living Radical Polymerization, and Interfacial Polycondensation As Representatives of Chain-Growth Polymerization, Living Polymerization, and Step-Growth Polymerization
3. Contact Angle Goniometry for Surface Tension Measurements of Solid Surfaces Zisman Plot and Surface Treatment Techniques
4. Synthesis of Luminescent Poly(p-phenylenevinylene)-Amylose Composites

Read the experimental guideline before each experiment. In addition, a report task is assigned for each experiment. After organizing, analyzing, and considering the experimental results, submit it as a report by the submission deadline.

●Textbook
Use an experimental guideline prepared for each topic. How to obtain the experimental guideline will be announced during the experiment guidance.

●Additional Reading
Other instructions will be given as needed.

●Grade Assessment
Grading will be decided based on the approach to the experiment (positiveness, activeness), logical thinking / judgment for the results, experimental skills and reports. Credits will be awarded to those students who score 60 or more out of 100 points. By passing both experiments of Inorganic/Physical Chemistry Experiment and Polymer Chemistry Experiment, you can earn the credits for this experiment.

Grades are as follows:

Enrollees after 2020
100-95 : A+94-80 : A79-70 : B69-65 : C64-60 : C-59-0 : F

Enrollees before 2019
100-90 : S89-80 : A79-70 : B69-60 : C59-0 : F

●Notes
It is assumed that you have earned credits for Safety in Laboratory.

●Contacting Faculty
Professors and teaching assistants will answer the questions.

Advanced Chemisty Tutorial A (1.0credits) (特別演習Ａ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Chemistry
Starts 1	4 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

In the tutorial lessons, we will perform the reading and discussions on the reference books (English) in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. We will feed application ability, a process of the study, and a way of thinking about the inventions.

●Prerequisite Subjects

All classes on chemistry and biochemistry

●Course Topics

Textbooks and papers will be suggested in each research group: Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Mateial Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, EcoNano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design

●Textbook

Textbooks and papers will be suggested in each research group.

●Additional Reading

Students will be suggested some references.

●Grade Assessment

Depends on research groups. In general, oral examinations and/or reports for the basic knowledge on each research field.

●Notes

●Contacting Faculty

Ask to the corresponding Professors in each research group.

Advanced Chemisty Tutorial B (1.0credits) (特別演習Ｂ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Chemistry
Starts 1	4 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

In the tutorial lessons, we will perform the reading and discussions on the reference books (English) in conjunction with the chemistry and biochemistry. We will feed the basics about chemistry and biochemistry in English, and discuss a research theme deeply. We will feed application ability, a process of the study, and a way of thinking about the inventions.

●Prerequisite Subjects

All classes on chemistry and biochemistry

●Course Topics

Textbooks and papers will be suggested in each research group: Gene Engineering and Molecular Biology, Bioprocess Engineering, Environmental Biotechnology, Catalysis in Organic Synthesis, Biopolymer Chemistry, Structural Biotechnology, Cell and Molecular Bioengineering, Theoretical and Computational Chemistry, Physical Chemistry of Polymers, Organic Material Chemistry, Organic Synthesis, Organic Chemistry of Macromolecules, Organic Reactions, Inorganic Mateial Chemistry, Applied Analytical Chemistry, Bioanalytical Chemistry, EcoNano Materials Science, Function Design Chemistry, Organic Conversion Chemistry, Chemistry of Inorganic Reactions, Crystalline State Chemistry, Material Design Chemistry, Functional Materials Engineering, Division of Environmental Research, Division of Energy Science Research, Molecular Design

●Textbook

Textbooks and papers will be suggested in each research group.

●Additional Reading

Students will be suggested some references.

●Grade Assessment

Grades will be based on research activities in the laboratory. Minimum requirement is 60/100.

●Notes

●Contacting Faculty

Ask to the corresponding Professors in each research group.

Graduation Research A (5.0credits) (卒業研究Ａ)

Course Type	Specialized Courses
Class Format	Experiment and Exercise
Course Name	Chemistry
Starts 1	4 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.

Achievement target
1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.
2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Prerequisite Subjects

Undergraduate specialized classes

●Course Topics

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.

Achievement target
1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.
2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Textbook

Will be designated by the supervisor in each group.

●Additional Reading

Refer to the necessary books and papers according to your research theme.

●Grade Assessment

Grading will be decided based on research approach, discussion in group, and achievement of graduation thesis.
Grades will be based on research activities in the laboratory. Minimum requirement is 60/100.

●Notes

●Contacting Faculty

Ask to the supervisors in each group.

Graduation Research B (5.0credits) (卒業研究Ｂ)

Course Type	Specialized Courses
Class Format	Experiment and Exercise
Course Name	Chemistry
Starts 1	4 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Chemistry

●Course Purpose

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.

Achievement target
1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.
2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Prerequisite Subjects

Undergraduate specialized classes

●Course Topics

Through graduation research in each group, cultivate creativity and comprehensive ability as a researcher in the fields of chemistry and biochemistry.

Achievement target
1. Acquire basic knowledge including safe experimental methods in the fields of chemistry and biochemistry.
2. Understand how to conduct research using the knowledge of the courses, theoretical thinking, how to write dissertations, oral presentations, etc., and develop creativity and comprehensive ability as a researcher.

●Textbook

Will be designated by the supervisor in each group.

●Additional Reading

Refer to the necessary books and papers according to your research theme.

●Grade Assessment

Grading will be decided based on research approach, discussion in group, and achievement of graduation thesis.
Grades will be based on research activities in the laboratory. Minimum requirement is 60/100.

●Notes

●Contacting Faculty

Ask to the supervisors in each group.

Outline of Engineering III (2.0credits) (工学概論第３)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	3 Autumn Semester	4 Autumn Semester	4 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	Gang ZENG Lecturer Kiyohisa NISHIYAMA Designated Lecturer	Emanuel LELEITO Lecturer	GRIB Dina Lecturer

●Course Purpose

This course introduces the history, the current state and future prospects of R&D (research and development) in various sectors related to the field of engineering in Japan. This class consists of “omnibus-style” lectures, all provided in English.

What you will get tips in this lecture for:
Communication across different engineering fields
Communication across language barriers (English/Japanese)
Search skills for locating professional topics and information
Presentation skills

Reports and presentations, which require students to independently search necessary information, will be assigned in the lectures. The students should note that these reports are used for evaluation.

●Prerequisite Subjects

This lecture does not require any background subject. Fundamental knowledge will be clearly instructed.

●Course Topics

1. Science, Technology and Innovations in Embedded Computing Systems (Gang ZENG)
- This lecture gives an overview of the embedded computing systems related technologies in Japan. In particular, the latest innovations on the low-energy and automotive applications will be introduced.
- The students are asked to participate in group discussion to share their ideas and thoughts about energy conservation and future automobiles.

2. The innovative factors of technologies in Japan (Kiyohisa NISHIYAMA)
- This lecture provides the participants with the concept of 40 innovation principles. Some Japanese technologies are broken down into the combination of the principles as examples.
- The students each are asked to analyse a technology of interest found in Japan. The students will be able to grab the concepts of any technological innovations after completing this lecture.

3. Science, Technology and Innovation for Disaster Risk Reduction (Emanuel LELEITO)
- This lecture gives students an overview of the Scientific and Technology Innovations that have contributed to Japan’s leading role in Disaster Risk Reduction (DRR).
- DRR related discussions and presentation in class will help students exercise their creative thinking and problem solving skills.

4. Societal, Cultural and Economic Contexts of Engineering Practice in Japan (Dina GRIB)
- The last part of this course introduces you to the Science, Technology and Society studies (STS) field and provides a brief overview of how Japanese cultural, economic, societal and political tradition affects technological innovation and scientific research as well as how STI in turn affect Japanese culture, society and politics.
- The participants will be invited to conduct a mini case study using online materials, share their findings in

class and participate in group discussions.

●Textbook

Lecture materials will be distributed during at each lecture.

●Additional Reading

Lecture materials will be distributed during at each lecture.

●Grade Assessment

Credits will be awarded to those students who score over 60 out of 100 based on the following evaluation criteria:

1) Reports (60%): Each lecturer will ask you to prepare and submit reports to valuate your understanding of the topics taught. The reports will be worth 60% of the total score.
2) Presentation (40%): You will be asked to do a final presentation based on one or a combination of the topics taught. The presentation will require that you to do independent online research to gather necessary information and present the topic in 3-5 minutes. Your understanding of the topic as well as the effectiveness of your presentation will be evaluated. The presentation is worth 40% of the total score.

●Notes

The course will be delivered online via Zoom or Teams video conferencing with the help of NUCT. Prerecorded teaching materials are to be used partially and in this case students will be expected to use those to prepare for the the in-class discussions.

●Contacting Faculty

Questions are received during or after class time and via NUCT messenger.

Contact person: Emanuel LELEITO, leleito@nagoya-u.jp

View of Advanced Electrical/ Electronic and Information Engineering (2.0credits) (電気電子情報先端工学概論)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	3 Autumn Semester	4 Autumn Semester	4 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	Associated Faculty	Associated Faculty	Associated Faculty

●Course Purpose

This course discusses the fundamentals of, and current topics in each field of the advanced electrical, electronic and information engineering, with an overview of the status of their researches and developments in Japan. Topics to be introduced are those related with energy, material and device, information and communication, multimedia and so on.
Students will be familiar with the most advanced technologies in the above subject matter.

●Prerequisite Subjects

Physics, Electromagnetics, Mathematics

●Course Topics

This course consists of two parts:
1. Six lectures in the classroom which will be given by faculty members.
2. Tours to three laboratories of companies and/or research organizations.

These six lectures are divided three pairs of lectures and each pair is on one of Electrical Engineering, Electronics, and Information and Communication Engineering. Each lecture covers from the fundamental to the cutting-edge topics of the research area of the faculty member responsible to it.
During three tours, students will visit laboratories on energy generation and novel materials.

Submission of a report after each lecture and tour is mandatory.

●Textbook

Some books will be introduced in the lecture.

●Additional Reading

Some books will be introduced in the lecture.

●Grade Assessment

Submission of a report after each lecture and tour is mandatory. A knowledge of lectured advanced technologies in electrical,electronic and information engineering is evaluated by the reports. The final score is determined based on scores of these reports.Students must obtain a score of 60 or higher out of 100 to pass the course.

●Notes

Although the time slots assigned to this course are 3rd period (13:00-14:30) and 4th period (14:45-16:15),the tours may take longer time and finish after 16:15.
Students must attend all lectures and join all tours. If there is a student who missed a tour without notice, it compromises the reputation of Nagoya university.

Remarks in 2021
Due to the COVID-19 infection, the lecture is provided by on-demand on NUCT.
The students ask lecturers by through NUCT "message" system. (Note: in this class, different faculty members give lectures on each topic each time.)

●Contacting Faculty

Students are encouraged to ask questions during and after lectures.
Faculty members can also be contacted at their offices, as well as by phone or email.

The question about the contents of lecture should be asked of each lecturer. The question about the others can be asked of Hiroki KOJIMA (kojima@nuee.nagoya-u.ac.jp).

Introduction to Civil Engineering and Architecture (2.0credits) (環境土木・建築学概論)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Automotive Engineering	Automotive Engineering
Starts 1	3 Autumn Semester	4 Autumn Semester	4 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	Associated Faculty	Associated Faculty	

●Course Purpose

The objectives of this course are (1) to establish scenarios for certain social infrastructure projects, and thereby introduce relevant civil engineering theories and construction technology, as well as conduct site-visits; (2) to survey, through technical site visits, various aspects of urban and architectural studies, including building material experiments, energy conservation, and the recent development of regional disaster mitigation activities. After completing this course, students will be able to:1. Understand civil engineering theories and construction technology2. Understand urban and architectural studies.

●Prerequisite Subjects

As the objective of this class is to understand fundamentals of civil engineering and architecture, no background class is assigned.

●Course Topics

Lecture and Site-visit 1: Preservation of Historical AreaLecture and Site-visit 2: Architecture and cultureLecture and Site-visit 3: Nagoya University Disaster Mitigation Research CanterLecture 4: Social infrastructure and civil engineering (1) Expressway Development in JapanLecture 5: Social infrastructure and civil engineering (2) Maintenance and Operation of ExpresswaySite-visit 6: Maintenance and Operation of ExpresswaySite-visit 7: Traffic Control Center of ExpresswayReports will be assigned in each lecture.

●Textbook

Suggested in the class, if necessary.

●Additional Reading

Suggested in the class, if necessary.

●Grade Assessment

Students will be evaluated on written reports. To pass, students must understand the fundamentals of civil engineering theories and construction technology, and urban and architectural studies.

●Notes

No condition is required.

●Contacting Faculty

Questions are welcome. Please send your questions by e-mail.E-mail: nakamura@genv.nagoya-u.ac.jp (Dr. Nakamura), tobita@sharaku.nuac.nagoya-u.ac.jpDr. Tobita).