Outline of Department of Physical Science and Engineering (2.0credits) (物理工学序論)

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	1 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose
In this lecture, students learn research activities in the Department of Physical Science and Engineering as well as fundamental issues of physics.

●Prerequisite Subjects
Basic physics and mathematics

●Course Topics
(1)Explanation by the Dean: Outline of the department of physical engineering, research groups, and research fields
(2)Basics of computer literacy
(3)Activities of the research groups

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

Passing grade: 60 points out of 100

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Physical Science and Engineering Tutorial 1 (1.0credits) (物理工学演習１)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	1 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Keiji YADA Assistant Professor

●Course Purpose

Exercises on Mechanics are given.
The purpose of this exercises is to achieve the skills to solve the basic problems of mechanics. The comprehensive understandings of the basic concepts of mechanics
is obtained.
The students will get the following skills.
1. Solving the basic problems of the mechanics
2. Explaining the solutions to the other people.

●Prerequisite Subjects

Mechanics I and Mechanics II

●Course Topics

Solve typical exercises on mechanics.
1. motion of a particle
2. single particle mechanics
3. work and energy
4. universal gravitation
5. relative motion
6. many particle mechanics
7. rigid body mechanics

Reports should be submitted.

●Textbook

Prints of exercises are provided.

●Additional Reading

To be designated.

●Grade Assessment

Evaluated by solutions and reports. Record more than 60/100 is qualified.

●Notes

It is desirable to study mechanics I and II.

●Contacting Faculty

Always

Atomic Physics (2.0credits) (原子物理学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	1 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Hidefumi ASANO Professor

●Course Purpose

Microscopic phenomena on an atomic scale cannot be understood in the framework of classical physics. History on development of quantum physics is presented.

Goal of study:

1. Understanding of physical logic that derives laws from experimental facts.
2. Understanding of cavity radiation on the basis of the concept of quantum physics.
3. Understanding of atomic structure and optical spectra.

Through the above learning, basic skills to learn the modern quantum physics is acquired.

●Prerequisite Subjects

Mechanics, Electromagnetics, Mathematics, Chemistry

●Course Topics

1. Introduction to atomic physics
2. Cavity radiation
3. Particle behavior of light, Photoelectric effects and Compton scattering
4. Wave behavior of particles, de Broglie wave
5. Superposition of wave and uncertainty principle
6. Bohr's theory of atomic model and atomic spectra
7. Schrödinger equation and wave function

●Textbook

Will be introduced in the class.

●Additional Reading

Quantum Mechanics: The Basics by H. Kamimura, and T. Yamamoto
Quantum Mechanics by I. Harada, and T. Sugiyama
Quantum Mechanics by W. Greiner

●Grade Assessment

Examination and reports
Pass mark 60/100

●Notes

No requirement for taking the course.

●Contacting Faculty

After the lecture.

Mathematics I and Tutorial (4.0credits) (数学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Department of Physical Science and Engineering		
Starts 1	2 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Hiroshi IKUTA Professor	YukiKAWAGUCHI Associate Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

This course deals with vector analysis and ordinary differential equation. It aims to help students acquire the basic concepts and principles of these mathematical methods and to get the necessary proficiency to apply them to problems in engineering. It targets students who have completed freshman-level mathematics and physics courses and who are going to major advanced engineering subjects.

After completion of this course, the students are expected to
1. understand the concept of vector and can apply it to practical problems,
2. be able to solve geometrical problems such as curves and surfaces using vectors,
3. understand the methods to calculate quantities of a scalar or vector field and can solve basic problems,
4. acquire the methods to solve various types of first order differential equations and can solve practical problems,
5. be able to solve second order linear equations,
6. understand the relation between a higher order linear equation and a system of first order linear equations, and acquire the method to solve the latter.

●Prerequisite Subjects

Fundamentals of Mathematics I, II, III, IV, Fundamentals of Physics I, II

●Course Topics

1. Vector Analysis
1-1 Basic properties of vector
1-2 Differentiation of vector
1-3 Curves
1-4 Surfaces
1-5 Vector field
1-6 Integral theorems for vector field
2. Ordinary differential equation
2-1 Physical laws and ordinary differential equations
2-2 Elementary methods of solution for differential equations
2-3 Second order differential equation with constant coefficients
2-4 Second order differential equation with variable coefficients
2-5 High-order linear differential equation and system of first order differential equations

The students are required to read the designated part of the textbook before each class. After the class, the students should solve the examples and the problems given in the textbook by themselves. In addition, there will be several report assignments that should be submitted.

●Textbook

1. An Introductory Course of Mathematics for Science and Engineering 3, Vector Analysis, Morikazu Toda, Iwanami Shoten
2. An Introductory Course of Mathematics for Science and Engineering 4, Ordinary Differential Equation, Nobuo Yajima, Iwanami Shoten

●Additional Reading

Will be suggested during the course.

●Grade Assessment

Grading will be based on the level of achievement evaluated by reports, midterm exam, and final exam. For both vector analysis and ordinary differential equation, students have to demonstrate the capacity to deal with at least simple problems to pass the course.

●Notes

There is no course requirement.

●Contacting Faculty

During the break after the lecture, or during the office hours.

Analytical Mechanics and Tutorial (3.0credits) (解析力学及び演習)

Course Type	Basic Specialized Courses
Class Format	Lecture and Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Makoto KUWAHARA Associate Professor

●Course Purpose

After learning the Newtonian mechanics for motion of point particles, analytical method for oscillators with many degrees of freedom and solid bodies using Lagrangean is given. Variational method and canonical equation of motion are also presented.

●Prerequisite Subjects

Analysis, Linear algebra, Mechanics I and, Mechanics II

●Course Topics

1. Newtonian mechanics 2. Motion of solid bodies, Principle of virtual work 3. D'Alembert principle 4. Lagrange's equation 5. Motion of Koma, 6. Variational principles 7. Small oscillations 8. Forced oscillations and damping oscillations 9. Scattering problem 10. Hamilton's equation 11. phase space and Canonical transformation and generating functions 12. Poisson bracketsYou should prepare for the next lecture and understand the meaning of technical terms.

●Textbook

None

●Additional Reading

Classical Mechanics (H.GoldStein), Mechanics (Landau lecture series)

●Grade Assessment

Evaluation will be made by exercises after every lectures and final semester examination with an equal weight. Students who mark more than 60 points out of 100 points are passed.If you are absent from the final examination, the score will be "ABSENT".In case of less than 59 points, the students who attend to the final examination will have score "F".

●Notes

None

●Contacting Faculty

ext.: 3597 email: kuwahara@imass.nagoya-u.ac.jp

Thermodynamics (2.0credits) (熱力学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Shunsuke MUTO Professor

●Course Purpose

Thermodynamics is concerned with physical and chemical phenomena which involve heat and temperature. We learn basic ideas of thermodynamics, their physical meanings and calculation methods. We understand implications of two laws on which thermodynamics is based, and learn that some universal relations between thermal phenomena are deduced from these laws.

●Prerequisite Subjects

Mechanics I, Mechanics II, Differential and integral calculus I, Differential and integral calculus II, Mathematics I and exercise

●Course Topics

1. Equilibrium and state variables 2. First law of thermodynamics 3. Properties of ideal gas 4. Heat capacity and real gas 5. Heat engine and Carnot's cycle 6. Second law of thermodynamics 7. Thermodynamic absolute temperature 7. Free energy and thermodynamic functions 8. Maxwell equations 9. Direction of state change and stability 10. Equilibrium conditions and chemical potential 11. Phase diagram

●Textbook

not particularly specified, but is mentioned in a lecture.

●Additional Reading

Thermodynamics & Statistical Mechanics: W. Greiner(Spriner-Verlag)
Statistical Mechanics: Ryogo Kubo (Elsevier)

●Grade Assessment

Evaluation of each object achievement is equally evaluated. Intermediate exam 30%, final exam 60%, and report 10%. Score of at least 60 points out of a possible 100 is required to pass.

●Notes

●Contacting Faculty

Inquiries concerning the subject are accepted during the lecture and related exercise time as well as after the lecture.

Physical Science and Engineering Tutorial 2a (1.0credits) (物理工学演習２ａ)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Shunsuke MUTO Professor

●Course Purpose

Exercises on Thermodynamics and other subjects are given. The aim of this course is for the students to become able to understand how the fundamental thermodynamics principles apply to understand the actual macrocopic system through solving problems.

●Prerequisite Subjects

Thermodynamics

●Course Topics

Solve exercises on thermodynamics and submit the written answers.

●Textbook

Prints on exercises are provided.

●Additional Reading

To be designated.

●Grade Assessment

Evaluated by solution on blackboard (70%) and reports (30%). Record more than 60/100 is qualified.

●Notes

●Contacting Faculty

In principle, questions are accepted durting the excercise.

Physical Science and Engineering Tutorial 2b (1.0credits) (物理工学演習２ｂ)

Course Type	Basic Specialized Courses	
Class Format	Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	2 Spring Semester	
Elective/Compulsory	Compulsory	
Lecturer	Taishi TAKENOBU Professor	Masaaki Araidai Assistant Professor

●Course Purpose

To gain further understanding of electromagnetics and vector analysis by solving a number of questions related to the lectures (Electricity and Magnetism I and II). One can acquire the ability to solve the questions in graduate school entrance examination.

●Prerequisite Subjects

Electricity and Magnetism I and II.

●Course Topics

Solve a number of questions related to the lectures (Electricity and Magnetism I and II) in the following order and submit your answers.

1. Mathematical basis for electromagnetics
2. Force acting on electrical charge and electrostatic field
3. Electrostatic potential and electrical conductor
4. Electrostatic field in material (electric dipole only)
5. Magnetostatic field
6. Magnetostatic field in material (magnetic dipole only)
7. Time-varying electromagnetic field

●Textbook

Assignment sheets are provided.

●Additional Reading

Electricity and Magnetism, Edward M. Purcell, David J. Morin.
Introduction to Electrodynamics, David J. Griffiths.
Classical Electrodynamics, John David Jackson.

●Grade Assessment

Evaluated by score of assignments. Score more than 60/100 is qualified.

●Notes

Expected to have got the course credit of `Electricity and Magnetism I' and now be taking `Electricity and Magnetism II', but not necessarily.

●Contacting Faculty

Always.

Physical Science and Engineering Laboratory 1 (1.0credits) (物理工学実験第１)

Course Type	Basic Specialized Courses		
Class Format	Experiment		
Course Name	Department of Physical Science and Engineering		
Starts 1	2 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Koji ASAKA Lecturer	Kazumasa IIDA Associate Professor	Mitsuo SAKASITA Assistant Professor
	Hitoshi NAKAHARA Assistant Professor	Yasunori YOKOYAMA Assistant Professor	Hisaaki TANAKA Assistant Professor
	SHIBAYAMA Shigehisa Assistant Professor	Takafumi ISHIDA Assistant Professor	TakafumiHATANO Assistant Professor
	Yuto NAKAMURA Assistant Professor	Takahiro URATA Assistant Professor	PU Jiang Assistant Professor
	Masahiro OTSUKA Assistant Professor	Tatsuya YOKOI Assistant Professor	Takuya SASAKI Assistant Professor
	Tetsuya HAJIRI Assistant Professor	Masahiko KATOH Assistant Professor	

●Course Purpose

We provide a minimum set of basic experiments on physics which is necessary to learn before entering each subject of research. Through the experiments, students are able to acquire not only basic experimental techniques but also attitudes toward the experimental research and to obtain comprehensive faculty of both knowledge and experimental technique for research of applied physics.

●Prerequisite Subjects

●Course Topics

After the orientation, students are divided in groups consisting of two or three students to make experiments. Lectures on data processing, report preparations, and presentations are also given. At the last weeks, students make an oral presentation. Tutorials on each experiment are made by assistant professors.

1.Optical fibers
2.The Stefan-Boltzmann's law
3.Digital circuits
4.Analog circuits
5.Planck's constant
6.Elementary electric charge
7.Heat capacity of solids
8.Electric properties of metals and semiconductors
9.Experiments on vacuum
10.Sound-velocity of ultrasonic pulse

●Textbook

Basic Experiments in Applied Physics (ed.by Dept.of Appl.Phys., Nagoya Univ.) (in Japanese). The textbook is distributed in the first lecture. Students should bring their own notebook, scientific calculator, and graph paper.

●Additional Reading

N/A

●Grade Assessment

Evaluated by the report on data processing and ten reports on each subject and the oral presentation. Record more than 60/100 is qualified. Unless there is a very special reason, students must attend all lectures and experiments and submit reports for data processing and all ten experiments. Delay of report submission is marked.

●Notes

N/A

●Contacting Faculty

If you have any question, contact to each assistant professor.

Bioscience (2.0credits) (生物科学)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Spring Semester
Elective/Compulsory	Elective
Lecturer	Tomoki TERADA Associate Professor

●Course Purpose

To prepare for Biophysics in 3rd grade, students learn about fundamental knowledge in modern biology and develop the ability of understanding biological processes in terms of the behavior of the mixture of biomolecules.

Students will be able to

1. Understand and explain the hierarchical structure of living organisms.
2. Understand and explain the structures and characteristics of biomolecules.
3. Understand and explain the biological phenomena in terms of the behavior of biomolecules.

●Prerequisite Subjects

Not specified because this lecture is intended for students majoring in physics.

●Course Topics

1. The diversity and generality of living organisms
2. Replication of genetic information
3. Gene expression
4. Regulation of gene expression
5. Metabolisms

Students are recommended to read the corresponding part of the textbook. Besides, students submit several assignments.

●Textbook

"Life science" 3rd Ed. Yodosha (in Japanese)

●Additional Reading

Specified within the lecture.

●Grade Assessment

Level of achievements of students' objects will be evaluated by reports (30%) and term-end exam (70%). Credits are given if the students can appropriately solve basic questions on biological science with a score of 60 or higher out of 100.

●Notes

There is no requirements for this lecture.

●Contacting Faculty

Questions are welcome at the end of every lecture.

Mathematics II and Tutorial (4.0credits) (数学２及び演習)

Course Type	Basic Specialized Courses	
Class Format	Lecture and Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Shao_Liang Zhang Professor	KEMMOCHI Tomoya Assistant Professor

●Course Purpose

The goal of this course is to get a detailed understanding of Fourier analysis and many of its applications such as partial differential equations.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Electromagnetics III (2.0credits) (電磁気学III)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Koh SAITOH Professor

●Course Purpose

Developing electromagnetism I and II, Maxwell's equations, wave propagation of electric and magnetic fields, polarization, energy and momentum of electromagnetic waves, propagation of electromagnetic waves in medias, wave guides, electromagnetic potential, retarded potential, radiation of electromagnetic waves will be lectured. The goal of the achievement is i) to understand the laws of electrostatics and magnetostatics and Maxwell's equations, and ii) their applications to propagations and radiations of electromagnetic waves.

●Prerequisite Subjects

Differential and integral calculus, Linear algebra, Mathematics I and II, Electromagnetism I and II

●Course Topics

1. Maxwell's equations
2. Propagation of electromagnetic waves in vacuum
3. Plane wave and spherical wave
4. Energy and momentum of electromagnetic waves
5. Propagation of electromagnetic waves in media
6. Wave guide
7. Electromagnetic potential
8. Retarded potential
9. Radiation of electromagnetic waves
10. Electromagnetic field by accelerating particles

Every students are encouraged to read handouts of the lectures which are uploaded on the following web site in advance.
http://sirius.imass.nagoya-u.ac.jp/~saitoh/em3/em3.html

●Textbook

Handouts are provided in each of the lectures.The handouts can be downloaded from the following web site.

http://sirius.imass.nagoya-u.ac.jp/~saitoh/em3/em3.html

●Additional Reading

Introduction to Electrodynamics 4th ed. (D. J. Griffinths, Pearson)

●Grade Assessment

The achievement will be evaluated by a midterm exam and a term exam. The weights of the marks of the midterm and term exams are 50 % and 50 %, respectively. Those who mark more than 60 points out of 100 points are passed.

●Notes

●Contacting Faculty

Questions are accepted right after the lectures at the lecture room or the office. Students should make an appointment for for the question by telephone or email in advance.

Quantum Mechanics A (2.0credits) (量子力学Ａ)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Satoshi KASHIWAYA Professor

●Course Purpose

Students lean the basic concepts and physical meaning of quantum mechanics which explains microscopic and nano-scale world. Students becomes interested in the world of quantum mechanics and master basic concept and how to solve basic equations. In the introduction, they learn a break down of the classical mechanics and necessity quantum mechanics. Solving practical problems, they study the physics and theory of quantum mechanics.

●Prerequisite Subjects

Mathematics 1,2 with Exercises, Atomic Physics, Mechanics and Mechanics Exercise

●Course Topics

1History of quantum mechanics
2. Matter wave
3. Schrodinger equation
4. Uncertainty relation
5. Mathematical basis
6. One dimensional square potential
7. Scattering problem in one dimension
8. Harmonic oscillator

Prepare and review class content and understand the meaning of technical terms.

●Textbook

Ryousi-rikigaku I: Isao Harada, Tadao Sugiyama (Kodansha)

●Additional Reading

Kisokarano-Ryoushi-Rikigaku (H. Kamimura and T.Yamamoto)

●Grade Assessment

The purposes of this lecture are following. 1. Students understand the basic concept of quantum mechanics and are able to explain it. 2. They can perform calculation for Schroedinger equation. 3. They understand the physics and are able to explain it. They master the fundamental ability to calculate various problems. We will evaluate by examination and reports.

●Notes

Nothing special.

●Contacting Faculty

After each lecture.

Statistical Mechanics A (2.0credits) (統計力学Ａ)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Masaki SASAI Professor

●Course Purpose

Macroscopic i.e., human-size or laboratory-size properties of materials are manifestations of very many atoms and electrons constituting the material. Statistical mechanics gives a framework to relate the atomic properties to the macroscopic properties. In this course fundamental concepts and skills in statistical mechanics as well as the physical perspective of these methods are explained.

●Prerequisite Subjects

Analytical Mechanics,Thermodynamics, Quantum mechanics

●Course Topics

1. Atomic theory and statistical mechanics
2. Principle of equal probabilities and microcanonical distribution
3. Applications of methods of microcanonical distribution
4. Ideas of canonical distribution, free energy, and thermodynamic laws
5. Applications of methods of canonical distribution
6. Classical statistical mechanics and its application
7. Open systems and chemical potential
8. Ideas and applications of grandcanonical distribution

●Textbook

Tokei-Rikigaku (Statistical Mechanics) by Y. Nagaoka (Iwanami)

●Additional Reading

Statistical Mechanics: An Advanced Course with Problems and Solutions by Kubo, Ryogo, and Ichimura, Hiroshi, and Usui, Tsunemaru

●Grade Assessment

Examinations(middle:30%, term end:70%). Record more than 60/100 is qualified. Ones who do not attend the intermediate or final examination are regarded as "abscent".

●Notes

Knowledge of analytical mechanics and thermodynamics is assumed. Knowledge of elementary quantum mechanics is used in lecture.

●Contacting Faculty

During or after the class.

Physical Science and Engineering Tutorial 3a (1.0credits) (物理工学演習３ａ)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Satoshi KASHIWAYA Professor

●Course Purpose

Exercise on Quantum Mechanics A is given.Solve typical exercises on Quantum Mechanics A and related Applied Mathematics. Students are expected to present their answers by reports or by the presentation using blackboard.

●Prerequisite Subjects

Quantum Mechanics A, Calculus I&II, Linear Algebra I&II, and Complex Function Theory

●Course Topics

1History of quantum mechanics
2. Matter wave
3. Schrodinger equation
4. Uncertainty relation
5. Mathematical basis
6. One dimensional square potential
7. Scattering problem in one dimension
8. Harmonic oscillator

Solve typical exercises on these topics of Quantum Mechanics.

●Textbook

Ryousi-rikigaku I: Isao Harada, Tadao Sugiyama (Kodansha)
Every time of this exercise, assignments are handed out. The assignments are based on the textbooks which are used in the corresponding lectures of Quantum mechanics A.

●Additional Reading

References are introduced during the lecture.

●Grade Assessment

Students are evaluated by reports or/and the presentation at blackboard.
A student will get credit if he/she marks score of more than 60/100 for the assignments in average.

●Notes

Nothing special condition is required to take this class. However, students are expected to study and review Quantum Mechanics A before attending this class.

●Contacting Faculty

After each lecture.

Physical Science and Engineering Tutorial 3b (1.0credits) (物理工学演習３ｂ)

Course Type	Basic Specialized Courses	
Class Format	Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Masaki SASAI Professor	Joji CHIKENJI Assistant Professor

●Course Purpose
The aim of this tutorial is to help students acquire an understanding of the fundamental principles of statistical mechanism and applied skills in physical science and engineering. At the end of the course, participants are expected to solve the problems of statistical mechanism and explain the solution.

●Prerequisite Subjects
Statistical Mechanics A

●Course Topics
Solve typical exercises on Statistical Mechanics A.Reports should be submitted for other exercises.The tutorial covers following topics.1. Atomic theory and statistical mechanics2. Principle of equal probabilities and microcanonical distribution3. Applications of methods of microcanonical distribution4. Ideas of canonical distribution, free energy, and thermodynamic laws5. Applications of methods of canonical distribution6. Classical statistical mechanics and its application7. Open systems and chemical potential8. Ideas and applications of grandcanonical distribution

●Textbook
Prints of exercises are provided.

●Additional Reading
Statistical Mechanics: An Advanced Course with Problems and Solutions by Kubo, Ryogo, and Ichimura, Hiroshi, and Usui, Tsunemaru

●Grade Assessment
Evaluated by answers and reports. Students can earn credits if they can correctly deal withbasic problems in statistical mechanics.If students can handle more difficult problems, they will get better grades.

●Notes
Attend the lecture, Statistical Mechanics A.

●Contacting Faculty
During exercise or at the laboratory office.

Physical Science and Engineering Tutorial 4a (1.0credits) (物理工学演習４ａ)

Course Type	Basic Specialized Courses	
Class Format	Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Kenji SHIRAISHI Professor	Joji CHIKENJI Assistant Professor

●Course Purpose
The aim of this tutorial is to help students acquire an understanding of mathematics for physics and applied skills in physical science and engineering. At the end of the course, participants are expected to solve the problems of mathematics that are used in physics and explain the solution.

●Prerequisite Subjects
Mathematics for Physics

●Course Topics
Solve typical exercises on Mathematical Methods that are used in physics.Reports should be submitted for other exercises.The tutorial covers following topics.1. Second order linear differential equations2. Series solutions of differential equations3. Complex Functions4. Complex Integral

●Textbook
Prints of exercises are provided.

●Additional Reading
Special Functions by T. Inui

●Grade Assessment
Evaluated by answers and reports. Students can earn credits if they can correctly deal withbasic problems in mathematical methods.If students can handle more difficult problems, they will get better grades.

●Notes
Although there is no requirement for course registration, attending the lecture, Mathematics for Physics, is highly desireble.

●Contacting Faculty
During exercise or at the laboratory office.

Physical Science and Engineering Tutorial 4b (1.0credits) (物理工学演習４ｂ)

Course Type	Basic Specialized Courses	
Class Format	Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	2 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Koh SAITOH Professor	Takashi UNEYAMA Associate Professor

●Course Purpose
This is a companion course to Electromagnetics III, and offers practical exercises for mastering the concepts introduced in the lecture courses.The purpose of this course is to obtain the following skills:1. To solve problems of electromagnetics.2. To explain the solutions for problems.

●Prerequisite Subjects
Electromagnetics I, Electromagnetics II, Electromagnetics III, Calculus I & II, Linear Algebra I & II, Complex Analysis

●Course Topics
Exercises for solving various problems related to the lecture courses of Electromagnetics III. The problems for following topics will be given:1. Maxwell's equations2. Electromagnetic wave3. Electromagnetic potential4. Moving chargesThe problems which cannot be solved will be treated as assignments. Students should review related topics in Electromagnetics III before the exercises.

●Textbook
The textbooks for the lectures Electromagnetics I, II, and III.

●Additional Reading
Additional materials will be introduced according to the specific targets of the exercise problems.

●Grade Assessment
Weekly assignments; attendance; class participation. (Weighting to be advised.)Whether a student obtained the required skills or not is evaluated by scores for the assignments. Record more than 60/100 is qualified.

●Notes
Students taking the lecture course Electromagnetics III should also take this tutorial class.

●Contacting Faculty
Questions are welcome after each exercise. It is better for students to contact the lecturer by telephone or e-mail boforehand.

Solid State Physics 1 (2.0credits) (物性物理学第１)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Hiroshi SAWA Professor

●Course Purpose

The lectures on solid-state physics are given a series of 4 lectures. This is the first lecture on solid-state physics. The primary aim of this lecture is to study how the crystalline structure on atomic level is determined experimentally by X-ray diffraction. For that purpose, it is necessary to have proper understanding of the new concepts such as reciprocal space, reciprocal lattice, structure factors. These concepts will be explained in detail with some examples.

●Prerequisite Subjects

Atomic Physics,General Physics I,II, General chemistry I

●Course Topics

1. Solid, Liquid, Gas Phase 2. Crystal Structure and Periodic Structure 3. X-ray Diffraction 4. Famous Crystal Structure 5. Real Space and Reciprocal Space 6. Bravais Lattice and Reciprocal Lattice 7. Typical Symmetry Elements 8. Bragg Condition 9. Laue Function and Diffraction Condition 10. Crystal Structure Factor 11. Structure Determination by X-ray diffraction

●Textbook

Introduction to solid state physics by C.Kittel

●Additional Reading

Solid State Physics by T. Mizoguchi (in Japanese), Shyouka-bou,

●Grade Assessment

Examination and Report

●Notes

No course requirements

●Contacting Faculty

Available anytime

Mail: sawa@mcr.nuap.nagoya-u.ac.jp

Oscillations and Waves (2.0credits) (振動と波動)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Takeshi KOYAMA Associate Professor

●Course Purpose

When a particle receives an external stimulus, it oscillates around an equilibrium point. In a system consisting of many particles connected with each other, an oscillation of a particle induces those of neighboring particles, and wave is formed. These oscillations and wave dynamics are physical phenomena that we look around as a swing and propagation of sound and light. In addition, their concept leads to the dynamics in quantum mechanics and alternative circuits. To learn oscillation and wave dynamics provides fundamentals for various fields in physical science and engineering.

[Outcomes]

1. The ability to explain simple harmonic motion and coupled oscillation of point particles
2. The ability to explain forced oscillation and resonance
3. The ability to explain wave propagation

●Prerequisite Subjects

1. Mathematics 1 with Exercises
2. Mathematics 2 with Exercises
3. Mechanics I
4. Mechanics II
5. Electromagnetics I
6. Electromagnetics II

●Course Topics

[Oscillation]

1. Simple harmonic motion
2. Damped oscillation
3. Forced oscillation and resonance
4. Connected oscillation
5. Oscillation of continuous system

[Waves]

6. Propagating wave
7. Reflection and transmission
8. Superposition of waves
9. Interference of waves
10. Propagation of light and Fresnel's theory
11. Kirchhoff's diffraction theory
12. Fresnel diffraction and Fraunhofer diffraction

●Textbook

Kodansha Fundamental Physics Series 2, Oscillation and Waves, S. Hasegawa (Kodansha)(Japanese)

●Additional Reading

- Berkeley Physics Course 3 Waves, translated by T. Takahashi (Maruzen)(Japanese)
- Optical Physics by T. Kushida (Kyoritsu)(Japanese)

●Grade Assessment

Examination (60%) and reports (40%)

●Notes

Knowledge acquired in the classes of Mathematics 1 with Exercises, Mechanics I, and Mechanics II

●Contacting Faculty

Students can ask questions after the class. Otherwise, contact the instructor.

Computer Programming (2.0credits) (計算機プログラミング)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Koh SAITOH Professor

●Course Purpose

Learning structured programming in C, data structures, and algorithms that are essiential in scientific computing. The purpose of this lecture is to learn fundamental skills for scientific computing.

●Prerequisite Subjects

●Course Topics

1. Introduction 2. Control Statements 3. Loops 4. Arrays 5. Functions in C 6. Pointers in C 7. Handling Files in C 8. Structures 9. Programming exercises (Newton's method, Euler's method, Heun's method, Lunge-Kutta method, central limit theorem, least square method, correlation coefficient)

●Textbook

Materials used in the lecture are given by web pages.

●Additional Reading

●Grade Assessment

Evaluation of the achievement will be made by exercises given in the lecture. Students who mark more than 60 points out of 100 points are passed.

●Notes

●Contacting Faculty

Questions are accepted during exercise in the lecture.

Mathematics for Physics (2.0credits) (物理数学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Kenji SHIRAISHI Professor

●Course Purpose

Mathematical Methods that are used in Physics are studied with the essential examples to give a deeper understanding of physical phenomena.

Goal

1. Students can use differential equations in solving real physical problems.
2. Students can understand complex function and complex integral.

●Prerequisite Subjects

Mathematics 1 with Exercises Mathematics 2 with Exercises

●Course Topics

1.Ordinary Differential Equation I
Study series expansion method for ordinary differential equation.
2.Ordinary Differential Equation II
Study special functions appeared in quantum mechanics by solving hyper geometric differential equations.
3.Complex Functions
Study basic knowledge of complex function.
4.Complex Integral
Study method to solve definite integral by using complex integral.

●Textbook

Mathematics for Physics by M. Wadati

Special Functions by T. Inui

●Additional Reading

Mathematics for Physics I by H. Fukuyama and M Ogata.

●Grade Assessment

Midterm Exam 40%, Final Exam 40% and Reports 20%. A passing mark is 60%.

●Notes

There is no conditions to resister.

●Contacting Faculty

Contact to the following adress
shiraishi@cse.nagoya-u.ac.jp

Mechanics of Continuum (2.0credits) (連続体の力学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Ken NIWA Associate Professor

●Course Purpose

Course Purpose
To understand mechanics of deformation, and to acquire basic knowledge about evaluation and analysis of mechanical properties of solids such as Young's modulus and shear modulus. Also to understand the concepts of viscous fluid and ideal fluid as the basis of fluid mechanics.

Outcomes
1. The ability to explain the concepts of strain and stress, and to express the concepts according to tensor analysis.
2. The ability to explain deformation of a body under the condition of elastic deformation, and the ability to derive elastic constants in various crystal systems.
3. The ability to derive the Navier-Stokes equations.

●Prerequisite Subjects

Mathematics 1,2 with Exercises Mechanics 1,2 with Exercises

●Course Topics

1. Strain
2. Stress
3. Relation between strain and stress
4. Mechanics of isotropic elastic body
5. Mechanics of viscous fluid
6. Mechanics of ideal fluid

●Textbook

Will be introduced in the class.

●Additional Reading

Will be introduced in the class.

●Grade Assessment

Passing grade: 60 points out of 100

●Notes

●Contacting Faculty

Questions are welcome within or after each lecture.

Computational Physics and Tutorial (2.0credits) (計算物理学および演習)

Course Type	Specialized Courses
Class Format	Lecture and Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Takashi UNEYAMA Associate Professor

●Course Purpose

Students learn fundamentals of computational physics and basic methods for investigating various problems in physics using computers. They also learn how to implement the methods to application problems, via exercises.The purpose of this course is to obtain the following skills:1. To perform discretizations for differential equations in physics.2. To explain the properties of various numerical calculation schemes.3. To implement computer programs with various numerical calculation schemes.

●Prerequisite Subjects

Mechanics, Mathematics 1 with Exercises, Mathematics 2 with Exercises, Computer Programming

●Course Topics

1) Introduction to Computational Physics2) Basics of Compueter Programming3) Numerical Methods for Ordinary Differential Equations4) Numerical Methods for Partial Differential EquationsThe exercises for the basics of programming and various numerical methods will be given. Students are required to submit solutions for exercise problems, as reports.

●Textbook

Not Specified. The lecture notes will be uploaded as PDF format files.

●Additional Reading

Not Specified

●Grade Assessment

Reports(40%) and an exam/exams (60%).Record more than 60/100 is qualified.A student, who is absent from the final exam, will receive an "Absent/Withdrawal" grade.The skill to implement computer programs with various numerical calculation schemes is evaluated by reports. The skills to perform discretizations for differential equations in physics and to explain the properties of various numerical calculation schemes are evalulated by the exam.

●Notes

Not specified, but students are recommended to take Computer Programming course before this course.

●Contacting Faculty

Questions are welcome within or after each lecture or exercise.

Quantum Mechanics B (2.0credits) (量子力学Ｂ)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Yukio TANAKA Professor

●Course Purpose

The aim is to understand the basic concepts of quantum mechanics, which is the basis for studying applied physics, and to acquire basic computational method. As a result, we will have a broader interest and interest in the quantum world and quantum phenomena.
By learning this lecture, the goal is to be able to achieve the following:
"Achievement target".
1. Understand the Schrodinger equation in the central force field.
2. Understand the energy levels and wave functions of hydrogen atoms and solve related problems.
3. Solving the Schrodinger equation of a system with a magnetic field.
4. Understand the fundamental concepts for angular momentum and spin.
5. Understand the mathematical background of quantum mechanics.
6. Understand the same kind of particles (fermions, Bose particles).
7. Understand approximation theory such as perturbation and solve related problems. We master basics of quantum mechanics and apply fundamental ability to solve various problems.

●Prerequisite Subjects

Mathematics 1,2 with Exercises,　Mechanics with Exercises, Atomic Physics, Quantum Mechanics A with Exercises

●Course Topics

1.Electron in a central force 2. Energy levels of hydrogen atoms 3.Shrodinger quation in the presence of magnetic field 4.Angular momentum and Spin 5.Mathmatical background of quamtum mechanics 6.Identical particles 7.Perturbation and variational method. Read the designated part of the textbook before each class. After the lecture, you will have to solve the textbook example and chapter end problems yourself.

●Textbook

Ryousi-rikigaku I: Harada & Sugiyama (Kodansha)
Ryoushi-rikigaku Okazaki (Shinbuturigaku Library)
Ryousi-rikigaku II: Ninomiya & Sugino & Sugiyama (Kodansha)

●Additional Reading

Kisokarano Ryoushi-Rikigaku (H. Kamimura and T. Yamamoto)
Ryoushi-rikigaku I(Keiji Igi, Hikari Kawai, Kodansha)
(Ryoushi-rikigaku Hara (Iwanami-shoten))

●Grade Assessment

Evaluate using final exams and quizzes conducted during class. Success criteria are to be able to explain the basic concept of each item of the achievement goal and to solve basic problems.

●Notes

It would be appreciated to understand the contents of Quantum mechanics A.

●Contacting Faculty

After classroom

Statistical Mechanics B (2.0credits) (統計力学Ｂ)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	TAKENAKAKoshi Professor

●Course Purpose

From the introduction of quantum statistical mechanics and its several practical applications, students learn the fundamental concepts and the mathematical techniques in statistical mechanics.
Goals:
1. Understanding the quantum statistical mechanics and calculation and the use of Fermi statistics and Bose statistics
2. Understanding and exploiting basic ideas in statistical mechanics

●Prerequisite Subjects

Thermodynamics, Statistical Mechanics A, Quantum Mechanics A

●Course Topics

This class consists of the following seven contents:
(1) Review of classical mechanics and quantum mechanics
(2) Classical statistical mechanics and quantum statistical mechanics
(3) Fermi statistics and Bose statistics
(4) Application of Fermi statistics
(5) Application of Bose statistics
(6) Systems with strong interactions
(7) Brownian motion

Read in advance the materials to be distributed and the corresponding sections in the textbook. You will be required to complete and submit nine reports during class.

●Textbook

Y. Nagaoka, Statistical Physics (Iwanami)
In addition to the above, materials are distributed in advance.

●Additional Reading

R. Kubo et ai., Statistical Mechanics (North-Holland Personal Library)

●Grade Assessment

(Evaluation method) In addition to the mid-term exam (full score: 50) and the final exam (full score: 100), the evaluation will be based on nine reports (full score: 10x9) that are imposed during class. 80% exams, 20% reports.

(Evaluation criteria) Passing grade: 60 points out of 100

●Notes

This course is based on the three subjects of Thermodynamics, Statistical Mechanics A, and Quantum Mechanics A specified in the background courses, as well as the mathematics and basic physics required to acquire these subjects. You can take the course even if you do not have the credits of the above three classes.

●Contacting Faculty

Questions are welcome within or after each lecture.

Solid State Physics 2 (2.0credits) (物性物理学第２)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	3 Spring Semester	
Elective/Compulsory	Compulsory	
Lecturer	Taishi TAKENOBU Professor	Masashi HASEGAWA Professor

●Course Purpose

Lectures on basic solid state physics are given. In particular, the main topics include the thermal properties of solids based on the lattice dynamics and dielectric properties of solids. Introduction of Einstein model of Heat capacity to show quantum properties of matter and lattice vibrations. Dispersion relation of one-dimensional chain and extension to diatomic lattice, Debye model of heat capacity based on lattice vibrations. In the second half, properties of dielectric materials, such as dielectric constant, are given.

●Prerequisite Subjects

Mechanics I,II and exercise, Thermodynamics, Electricity and Magnetism A,B, Atomic Physics, Solid State Physics 1, Oscillations and Waves

●Course Topics

First half
1. Introduction 2. Lattice vibrations 3. Heat capacity of solids - Classical theory 4. Heat capacity of solids - Quantum theory and Einstein model 5. Density of states 6. Heat capacity of solids - Debye model
Second half
1. Introduction 2. Metal and Dielectric materials 3. Maxwell equation 4. Dielectric constant and polarizability 5. Dielectric materials

Preparation for each subject should be made beforehand.

●Textbook

C. Kittel; Introduction to solid state physics (John Wiley and Sons, Inc)

●Additional Reading

T. Kurosawa; Condensed matter physics (Shokabo)
M. Shiga; Introduction to solid state physics (Uchida Rokakuho)
Y. Nagaoka; Electro-Magnetics I&II (Iwanami

●Grade Assessment

Evaluate the level of achievement for the target based on the examinations.

Understanding and explaining the basic concepts and ideas related to the crystal vibrations and dielectric materials. The score ration between first and second half is 50/50.

●Notes

It is desirable to have learned Mechanics I,II and exercise, Thermodynamics, Electricity and Magnetism A,B, Atomic Physics, Solid State Physics 1, and Oscillations and Waves.

●Contacting Faculty

Questions are welcome after each lecture.

Physical Science and Engineering Tutorial 5a (1.0credits) (物理工学演習５ａ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Yukio TANAKA Professor

●Course Purpose

This is an exercise to learn the basic quantum mechanics in understanding applied physics. It is based on the lecture "Quantum Mechanics B" and n basic content will ensure fundamental skills in quantum mechanics. In the process, you will train basic calculation skills. In addition, we will acquire the fundamentals of mathematical and quantum mechanics, which are the foundations of applied and comprehensive skills that can deal with various problems in physical engineering through exercises in applied problems.Achievement targetSolve specific problems learned in quantum mechanics B, make presentations, and submit reports. 1. Schrodinger equation of central force field; 2. energy level of hydrogen atom; 3. Schrodinger equation for systems with magnetic fields; 4. Basic concepts for angular momentum and spin; 5. Mathematical background of quantum mechanics; 6. homogeneous particles (fermions, Bose particles) 7 Problems related to the approximate theory such as perturbation.

●Prerequisite Subjects

Quantum Mechanics B

●Course Topics

The following are the subjects of the exercise. 1. Review of quantum mechanics A 2. Electron motion in the field of central force 3. Calculation of special functions such as Legendre function and Laguerre function 4. Electron motion in magnetic field 5. Mathematics of quantum mechanics such as Hermitian matrix, 6. Basic calculation of angular momentum, spin angular momentum, Pauli matrix, etc., 7. Perturbation calculation (time-independent perturbation, time-dependent perturbation), 8. Variational calculation. After the exercises, problems that do not end within the class time are assigned as report tasks.

●Textbook

Prints distributed at the class hours

●Additional Reading

Ryousi-rikigaku I: Harada & Sugiyama (Kodansha)Ryousi-rikigaku II: Ninomiya & Sugino & Sugiyama (Kodansha)Ryoushi-rikigaku Okazaki (Shinbuturigaku Library)Kisokarano Ryoushi-Rikigaku (H. Kamimura and T. Yamamoto)Ryoushi-rikigaku I(Keiji Igi, Hikari Kawai, Kodansha) (Ryoushi-rikigaku Hara (Iwanami-shoten))

●Grade Assessment

Evaluation is made based on the presentation status and assignment report during class hours. Pass if you can solve the basic problem of the content in the achievement target and submit the report

●Notes

It is desirable to understand the contents of quantum mechanics A (Schrodinger equation, well-type potential, scattering problem, harmonic oscillator), etc.

●Contacting Faculty

Lecture hours and after lecture

Physical Science and Engineering Tutorial 5b (1.0credits) (物理工学演習５ｂ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	TAKENAKAKoshi Professor

●Course Purpose

Exercises are given on Statistical Mechanics B, including quantum statistical mechanics, systems with strong interactions, and Brownian motion.
Goals:
1. Applying fundamental concepts in statistical physics to solving the concrete problems.
2. Explaining the solution appropriately.

●Prerequisite Subjects

Statistical Mechanics B

●Course Topics

Solve typical exercises on Statistical Mechanics B.

(1) Review of classical mechanics and quantum mechanics
(2) Classical statistical mechanics and quantum statistical mechanics
(3) Fermi statistics and Bose statistics
(4) Application of Fermi statistics
(5) Application of Bose statistics
(6) Systems with strong interactions
(7) Brownian motion

You will be required to complete and submit reports for each class.

●Textbook

Prints of exercises are provided.

●Additional Reading

R. Kubo et ai., Statistical Mechanics (North-Holland Personal Library)

●Grade Assessment

Evaluate the level of achievement for the target based on the submitted report. A score of 60 or more out of 100 is a passing score.

●Notes

There is no requirement for taking this class, but it is desired to take Statistical Mechanics B simultaneously or to have already finished it.

●Contacting Faculty

Questions are welcome within or after each lecture or exercise.

Physical Science and Engineering Laboratory 2 (1.5credits) (物理工学実験第２)

Course Type	Specialized Courses		
Class Format	Experiment		
Course Name	Department of Physical Science and Engineering		
Starts 1	3 Spring Semester		
Elective/Compulsory	Compulsory		
Lecturer	Koji ASAKA Lecturer	Mitsuo SAKASITA Assistant Professor	Naoyuki KATAYAMA Associate Professor
	Hitoshi NAKAHARA Assistant Professor	TakafumiHATANO Assistant Professor	Yasunori YOKOYAMA Assistant Professor
	Takafumi ISHIDA Assistant Professor	Hisaaki TANAKA Assistant Professor	Yuto NAKAMURA Assistant Professor
	Takahiro URATA Assistant Professor	PU Jiang Assistant Professor	Masahiro OTSUKA Assistant Professor
	Tatsuya YOKOI Assistant Professor	Takuya SASAKI Assistant Professor	Tetsuya HAJIRI Assistant Professor
	SHIBAYAMA Shigehisa Assistant Professor		

●Course Purpose

This course provides basic and essential experiments in applied physics, which are related to each research laboratory in the department. Students will acquire basic experimental techniques and analytical methods for applied physics.

●Prerequisite Subjects

Physical Science and Engineering Laboratory 1

●Course Topics

1.X-ray diffraction
2.Interference of light, Luminescence of semiconductor
3.Measurements of thermal expansion of solid materials
: Effects of lattice vibration and magnetic phase transition on thermal expansion
4.Metallurgical physics, Magnetic properties
5.Reflection high energy electron diffraction
6.Electrons as particles and waves/ Diffraction and imaging of photons
7.Characterization of electrical properties of semiconductor materials
8.Growth and fundamental characterization of magnetic thin films
9.Excess free energy of grain boundaries
10.Synthesis and characterization of cuprate superconductors
11.Magnetic resonance, conductivity measurements
12.Crystal structure and electronic state analyses of solid materials by diffraction and spectroscopy techniques

●Textbook

An assistant professor guides an experiment at each laboratory, and textbooks for each experiment are distributed. Students should bring their own notebook, scientific calculator, and graph paper.

●Additional Reading

Reference books for each experiment are individually specified.

●Grade Assessment

Evaluated by all reports on each experiment. Record more than 60/100 is qualified. Delay of report submission is marked.

●Notes

N/A

●Contacting Faculty

If you have any question, contact to each assistant professor.

Chemical thermodynamics (2.0credits) (化学熱力学)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	3 Autumn Semester	
Elective/Compulsory	Compulsory Elective	
Lecturer	Masashi HASEGAWA Professor	KatsuyukiMATSUNAGA Professor

●Course Purpose

In this lecture, students should learn thermodynamic treatments of solid and liquid solutions containing more than two constituent elements. Moreover, on the basis of thermodynamics, students can read two-component phase diagrams, and can understand microstructures of materials systems at particular temperature and chemical composition from phase diagrams.

●Prerequisite Subjects

Thermodynamics

●Course Topics

1. Basics of thermodynamics
2. Solid and liquid solutions
3. Phase equilibrium and phase rule
4. Representative phase diagrams of binary compounds
5. Materials microstructures
6. Pressure effects on phase transition
7. Atom diffusion in solids
8. Nucleation in phase transition

Students should read materials given by lectureres or the corresponding portions in the reference books before each lecture.

●Textbook

There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading

See the reference book titles of the syllabus in Japanese.

●Grade Assessment

Evaluate the level of achievement for the target based on the examination.

Understanding and explaining the basic concepts and ideas related to thermodynamics of binary solutions, the phase diagrams and the phase transition.

●Notes

It is desirable to have learned thermodynamics.

●Contacting Faculty

Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Physical optics (2.0credits) (物理光学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Hideo KISHIDA Professor

●Course Purpose

To understand the properties of light and interactions between light and matters, and acquire basic skills for optics and basic knowledge about optical applications.

Outcomes:
1. The ability to explain the reflection, refraction and propagation of light on basis of the knowledge of electromagnetic waves in matters and polarization of light.
2. The ability to explain the interaction between light and matters using a classical model of atoms.
3. The ability to explain the light emission and the principle of lasers.

●Prerequisite Subjects

Oscillations and Waves, Electromagnetics, Mathematics with Exercises

●Course Topics

1. Electromagnetic waves and polarization of light
1.1 Maxwell equations, 1.2 Fresnel's equations, 1.3 Polarized light, 1.4 Electromagnetic waves and birefringence in anisotropic media, 1.5 Electrooptical-effect, 1.6 Optical rotation and Faraday effect, 1.7 Relation with geometric optics

2. Interactions between light and matter
2.1 Spectroscopy, 2.2 Lorentz model, 2.3 Dispersion and absorption

3. Light emission and principle of laser
3.1 Photon, 3.2 Spontaneous emission and stimulated emission, 3.3 Luminescence, 3.4 Laser, 3.5 Nonlinear optical effects

●Textbook

Optical Physics, T. Kushida (Kyoritsu)
ISBN: 978-4320030374

●Additional Reading

Reference books will be introduced in the class.

●Grade Assessment

Examination and reports. The criterion of pass is to reach the basic level of the goals.

●Notes

Not required.

●Contacting Faculty

You can make questions after the class. Otherwise, contact the instructor.

Solid State Physics 3 (2.0credits) (物性物理学第３)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Hiroshi IKUTA Professor

●Course Purpose

This course deals with the basic concepts and theories that explain the behavior of electrons in a solid. It aims to help students to acquire basic knowledge about the mechanism of various properties that solids exhibit and to develop the ability of applying the knowledge to actual materials.

After completion of this course, the students are expected to 1. understand the free electron model and be able to calculate various electrical properties, 2. understand the behavior of electrons in reciprocal potential, and 3. be able to explain the physical properties of various materials based on the electronic structure.

●Prerequisite Subjects

Quantum mechanics, Thermodynamics, Statistical mechanics, Electromagnetism

●Course Topics

1. Introduction to electron theory of metals 2. Electrons in a crystal and the concept of energy band 3. Free electron model 4. Fermi momentum and Fermi sphere 5. Fermi-Dirac distribution function 6. Sommerfeld expansion 7. Electronic specific heat 8. Pauli paramagnetism 9. Periodic potential and Bloch's theorem 10. Kronig-Penney model 11. Electrons in a weak periodic potential 12. Energy gap and energy band 13. Reciprocal lattice and Brillouin zone 14. Fermi surface and electronic structure 15. Electronic structure of metals and semiconductors

The students are required to read the designated part of the textbook before each class. After the class, the students should solve the problems given at the end of each chapter of the textbook. In addition, there will be several report assignments that should be submitted.

●Textbook

“Introduction to the Electron Theory of Metals”, U. Mizutani (Cambridge University Press)

●Additional Reading

"Introduction to Solid State Physics", C. Kittel (Wiley)
"Solid State Physics", N. W. Ashcroft and N. D. Mermin (Thomson Learning)

●Grade Assessment

Grading will be based on the level of achievement evaluated by midterm and final exams. To pass, students have to demonstrate the capacity to deal with at least simple problems about the subjects lectured in the course.

●Notes

Nothing particularly needed

●Contacting Faculty

During the break after the lecture, or during the office hours.

Solid State Physics 4 (2.0credits) (物性物理学第４)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	3 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Osamu NAKATSUKA Professor	Hidefumi ASANO Professor

●Course Purpose

Fundamental physics in semiconductors and magnetic materials will be studied to deepen the understanding of various physical properties and their applications of these materials. Various quantum phenomena in electronic devices are also studied.

1. To understand the basic properties and concept in application of semiconductor materials.
2. To understand the basic properties and concept in application of magnetic materials.

●Prerequisite Subjects

Electromagnetism, Statistical physics, Quantum mechanics, Solid state physics 1-2

●Course Topics

1. Crystalline Structures of Semiconductor Materials
2. Donors and Acceptors in Semiconductors
3. Carrier Density and Fermi Level
4. Temperature dependence of Carrier Density
5. Carrier Transport Mechanisms
6. Thermodynamic equilibrium and non-equilibrium
7. pn Junctions
8. Origin of Magnetism
9. Properties of Magnetic Materials
10. Application of Magnetic Materials

Read related section in reference prints and books before each lecture. Solve example problems in reference prints by yourself after lecture.

●Textbook

The reference print is distributed though the textbook is not used.

●Additional Reading

Introduction to Solid State Physics: C.Kittel (John Wiley & Sons)
Semiconductor Devices: Physics and Technology: S. M. Sze (John Wiley & Sons)

●Grade Assessment

(1) The degree of achievement is comprehensively evaluated by two examinations, an intermediate examination and a final examination.
(2) When basic problems can be dealt with accurately for each of semiconductor and magnetic materials, it is judged acceptable. If more difficult problems can be solved, it is reflected in the evaluations according to the level.

●Notes

No requirement for taking the course.

●Contacting Faculty

Contact: Osamu Nakatsuka (ext. 5963, nakatsuka@nagoya-u.jp), Hidefumi Asano (ext. 3568 asano@numse.nagoya-u.ac.jp
The question on the overtime is accepted in the lecture room and the teacher's room after making an appointment for time by telephone or e-mail.

Physical Science and Engineering Laboratory 3 (1.5credits) (物理工学実験第３)

Course Type	Specialized Courses		
Class Format	Experiment		
Course Name	Department of Physical Science and Engineering		
Starts 1	3 Autumn Semester		
Elective/Compulsory	Compulsory		
Lecturer	Koji ASAKA Lecturer	Mitsuo SAKASITA Assistant Professor	TAKEUCHI Wakana Assistant Professor
	Naoyuki KATAYAMA Associate Professor	Hitoshi NAKAHARA Assistant Professor	TakafumiHATANO Assistant Professor
	Yasunori YOKOYAMA Assistant Professor	Takafumi ISHIDA Assistant Professor	Hisaaki TANAKA Assistant Professor
	Yuto NAKAMURA Assistant Professor	Takahiro URATA Assistant Professor	PU Jiang Assistant Professor
	Masahiro OTSUKA Assistant Professor	Tatsuya YOKOI Assistant Professor	Takuya SASAKI Assistant Professor
	Tetsuya HAJIRI Assistant Professor	SHIBAYAMA Shigehisa Assistant Professor	

●Course Purpose

This course provides basic and essential experiments in applied physics, which are related to each research laboratory in the department. Students will acquire basic experimental techniques and analytical methods for applied physics.

●Prerequisite Subjects

Physical Science and Engineering Laboratory 1

●Course Topics

1.X-ray diffraction
2.Interference of light, Luminescence of semiconductor
3.Measurements of thermal expansion of solid materials
: Effects of lattice vibration and magnetic phase transition on thermal expansion
4.Metallurgical physics, Magnetic properties
5.Reflection high energy electron diffraction
6.Electrons as particles and waves/ Diffraction and imaging of photons
7.Characterization of electrical properties of semiconductor materials
8.Growth and fundamental characterization of magnetic thin films
9.Excess free energy of grain boundaries
10.Synthesis and characterization of cuprate superconductors
11.Magnetic resonance, conductivity measurements
12.Crystal structure and electronic state analyses of solid materials by diffraction and spectroscopy techniques

●Textbook

An assistant professor guides an experiment at each laboratory. Textbooks for each experiment are distributed. Students should bring their own notebook, scientific calculator, and graph paper.

●Additional Reading

Reference books for each experiment are individually specified.

●Grade Assessment

Evaluated by all reports on each experiment. Record more than 60/100 is qualified. Delay of report submission is marked.

●Notes

N/A

●Contacting Faculty

If you have any question, contact to each assistant professor.

Biophysics (2.0credits) (生物物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Masaki SASAI Professor

●Course Purpose

Physical models are powerful tools to quantitatively analyze the complex biological phenomena. Basic physical knowledge of biomolecules and cells is explained to develop the ability to use such models. The interdisciplinary approach is emphasized as the creative style of science.

●Prerequisite Subjects

Biological Science, Thermodynamics, Statistical Mechanics

●Course Topics

1. World of cells (size, number, fluctuation)
2. From order to order (history of molecular biology, impact of structures)
3. From disorder to order (protein folding)
4. The proteome world
5. Free energy and cells (production and consumption of ATP, molecular motors)
6. Information processing in cells (gene switches)
7. Information circuit in cells (gene network)
8. Long-term memory in cells (epigenetics)
9. Fluctuation in cell differentiation

●Textbook

Notes for lecture (written in Japanese) are uploaded on NUCT site.

●Additional Reading

"Physical Biology of the Cell" Rob Phillips et al., Garland Science

●Grade Assessment

Report 30%, examination 70%
Ones who did not attend the final exam. will be regarded as "absent"

●Notes

Knowledge of statistical mechanics A and thermodynamics is assumed.

●Contacting Faculty

During or after the class.

Physics of Fluids (2.0credits) (流体物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Katsunori YOSHIMATSU Associate Professor

●Course Purpose
Advanced topics on physics of fluid are lectured to understand the physical mechanism and to obtain the mathematical method of the analysis.

●Prerequisite Subjects
Mechanics of continuum, vector analysis, differential equations, Fourier analysis

●Course Topics
1. Basic equations of flow dynamics
2. Motions in perfect fluid
3. Motions in viscous fluid
4. Flow Stability

●Textbook
not specified. Suggestions are given during the lectures.

●Additional Reading
Suggestions are given during the lectures.

●Grade Assessment
Evaluated by two examinations.

●Notes
No condition is required.

●Contacting Faculty
Question time: after each lecture. Email: yoshimatsu@nagoya-u.jp

Quantum Mechanics C (2.0credits) (量子力学C)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Kenji SHIRAISHI Professor

●Course Purpose

Thanks to the developments of material science, there have been discovered many functional materials. In this lecture, we aim to understand the origin of various material properties on the bases of quantum mechanics.

Goal
1. To understand electronic structures of solids
2. To understand band structures of materials

●Prerequisite Subjects

Electromagnetics Quantum mechanics Statistical mechanics,Solid state Physics I-IV

●Course Topics

1. Basis of quantum mechanics
2. Electronic structures in crystals
   2.1 LCAO approximation
   2.2 Lattice vector, Reciprocal lattice vector and Brillouin zone
   2.3 Band structures of various materials
   2.4 Graphene and carbon nanotube
   2.5 Effective mass approximation

●Textbook

●Additional Reading

We introduce text books about LCAO approximation in the lecture.

●Grade Assessment

Midterm exam (40%). Final exam (40%), Reports (20%). Passing grade is 60 points in 100 points. You can make questions after the class.

●Notes

There is no condition to register

●Contacting Faculty

Contact to the following adress
shiraishi@cse.nagoya-u.ac.jp

Chemical Physics (2.0credits) (化学物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory Elective
Lecturer	KatsuyukiMATSUNAGA Professor

●Course Purpose

Atomic arrangements and physical/chemical properties of atoms, molecules, and clusters can be determined by their electronic structures. Therefore, quantum chemistry and molecular orbital theory are essential, which also make it possible to predict and design novel materials. In this lecture, students learn basics of quantum chemistry and molecular orbital theory and attempt to apply them to various materials expected for practical applications.

●Prerequisite Subjects

Chemistry basics, linear algebra, Electromagnatism, Quantum mechanics

●Course Topics

1. Basics and quantum mechanics
2. Wavefunctions of hydrogen atom
3. Wavefunctions of muitielectron atoms
4. Molecular orbital theory
5. Diatomic molecules composed of s atomic orbitals
6. Diatomic molecules composed of p atomic orbitals
7. Diatomic molecules containing two different atoms
7. Molecules of more than three atoms
8. Stability and chemical reactions of molecules

Students should materials given by the lecturer or the corresponding portions of the reference books before each lecture.

●Textbook

There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading

See the reference book titles of the syllabus in Japanese.

●Grade Assessment

Evaluate the level of achievement for the target based on the examination.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to electronic theory and molecular orbital theory for atoms, molecules and clusters.

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome after each lecture.

Computational Algorithm (2.0credits) (計算アルゴリズム)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Tomohiro SOGABE Associate Professor

●Course Purpose

Numerical computation has a wide range of applications in physics, including analysis of experimental data, solution of a nonlinear equation that cannot be solved analytically and numerical simulation. In this class, we study the fundamentals of numerical algorithms. The goal is to understand the mathematical background of numerical algorithms .

●Prerequisite Subjects

Linear Algebra I and II, Analysis

●Course Topics

* Solution algorithms for nonlinear equations, linear simultaneous equations * Numerical differentiation and numerical integration * Interpolation of functions * Computation of the eigenvalues of matrices* Introduction of quantum computing

●Textbook

Mizushima, Yanase, Ishihara (2019) (ISBN: 978-4-86481-061-6)

●Additional Reading

Sogabe, Yamamoto (Kaneda, Sasai, Zhang eds.) (ISBN:978-4-320-12266-6)

●Grade Assessment

Examination, and partly report.

●Notes

●Contacting Faculty

At the end of class.

Electronic Circuits and Instrumentations (2.0credits) (電子計測工学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Kazumasa IIDA Associate Professor

●Course Purpose

In this course we will learn classical error theory and deterministic signal in order to correctly and accurately evaluate physical quantities. At the end of lecture participants are expected to have the following knowledege: error theory including propagation of error and various probability density functons, and basic analysis of deterministic signal.

●Prerequisite Subjects

Prerequisites may be mathematics, statistical physics, and solid state physics

●Course Topics

Half of the lecture deals with error theory, binomial distribution, Poisson distribution, hyper-geometric distribution, the most likelihood estimate, normal distribution, moment generating function, exponential distribution, Weibull distribution, and Markov process.

The rest of lecture deals with frequency spectrom of periodic signal, Fourier series and transform, characater of Fourier transform, sampling theorem, Discrete Fourier transform (DFT), fast Fourier transform (FFT), correlation function, window function.

●Textbook

No text books will be used. But, the files used for the lectures will be uploaded on NUCT. So please download relevant files prior to the lectures.

●Additional Reading

All recommended books are written in Japanese. Therefore, if one needs English books, please ask me.

●Grade Assessment

Grading will be based on examination (the midter/report 50% and the term exam 50%).
A passing grade is more than 60 points or more by 100 point full marks.

●Notes

No required conditions for taking this course.

●Contacting Faculty

Contact: ext. 3853, iida@mp.pse.nagoya-u.ac.jp

You may come to my office. However, it would be highly appreciated, if you contact me via e-mail or telephone prior to your visit.

Applied Solid State Physics (2.0credits) (応用物性)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	Yoshihiko OKAMOTO Associate Professor	Masashi KUROSAWA Lecturer

●Course Purpose

[Important Notice: this lecture has been completely changed from FY2019.]

The electronic properties of conduction electrons in the periodic fields in crystalline solids are not only interesting from the viewpoint of basic physics but also useful for us as various electronic devices. In this lecture, we will study various electronic properties and functions exhibited by metals and semiconductors, and aim to understand their origins and operating principles based on solid-state physics.

Goals and objectives:
Understanding various electronic properties that appear in crystalline solids.
Understanding the operating principles of various semiconductor devices.

●Prerequisite Subjects

Solid State Physics 1-4

●Course Topics

The first and second half will focus on the electronic properties of solids and semiconductor devices, respectively. The contents of each are as follows. Prepare for the next class and understand the meaning of technical terms.

1. Electronic Properties of Solids
  Peierls Transition
  Superconductivity
  Strongly Correlated Electron System
  Measurement of Fermi Surfaces

2. Semiconductor Devices
  Metal-semiconductor Contact
  Field Effect Transistor
  Photoelectric Device

●Textbook

Materials will be distributed each time.

●Additional Reading

C. Kittel, Introduction to Solid State Physics (John Wiley & Sons)
S. M. Sze and K. K. Ng, Physics of Semiconductor Devices (John Wiley & Sons)

●Grade Assessment

The criterion to receive academic credit is to understand the basic concepts of electronic properties of solids and semiconductor devices. Grades are evaluated by taking tests in the first and second half of the class. The results of the two tests are summed up, and a score of at least 60 out of 100 is the passing criterion.

●Notes

There is no requirement for taking this lecture.

●Contacting Faculty

Questions are welcome within or after each lecture.

Quantum Chemistry for Materials Science (2.0credits) (量子材料化学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Hiroshi ITO Associate Professor

●Course Purpose

To understand the physical properties of materials though various spectroscopic results, knowledge of electronic states based on quantum mechanics is indispensable. In this lecture, students learn the notion of molecular orbitals which enable to treat the electronic states of small molecules intuitively. Then, group theory is introduced to treat the symmetry of electronic states and to understand the material properties and molecular spectra. Finally, formation of electronic wave in crystals are lectured along solid-state physics.After learning this lecture, students are able to,1. Explain important notions of multi-electron quantum mechanics.2. Explain material properties based on molecular orbitals.3. Interpret results of molecular spectroscopy.4. Explain how electronic waves are formed in the crystal.

●Prerequisite Subjects

Basics of chemistry I, IIQuantum mechanics A, BCondensed Matter Physics 1,2,3,4

●Course Topics

1. Multi-electron quantum mechanicsLearn many-particle quantum mechanics, approximations, and exchange interactions.2. Chemical bonding and material propertiesLearn basics of molecular orbitals and understand material properties based onelectronic states.3. Basics of group theoryLearn group theory treatment of the symmetry of electronic states and interpretation of molecular spectra.4. Electronic wave extending to crystalsLearn crystal electronic structures and band theoryStudents should prepare for understanding technical terms before each lecture. Students must submit reports at the end of each subject. The reports are scored, returned and reviewed for measuring the achievement of understanding.

●Textbook

Textbook covering whole lecture contents is not specified. In the course of lecture, most appropriate chapters among reference books are introduced and necessary handouts are provided.

●Additional Reading

●Grade Assessment

Achievements (final examination 70%, reports 30%) are evaluated and the score above 60/100 is qualified. Students pass if they could treat precisely basic problems on electronic states based on molecular orbitals, symmetry and spectroscopy based on group theory, and electronic waves in crystals.

●Notes

Credits of quantum mechanics A, B and condensed matter physics 3 are desirable beforehand.

●Contacting Faculty

Questions are acceptable after at the end of each lectureTEL ex.5164, e-mail:ito@nuap.nagoya-u.ac.jp

Crystal Mechanics (2.0credits) (結晶力学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Atsutomo NAKAMURA Associate Professor

●Course Purpose

To understand mechanical property of materials is essential for producing new materials and designing industrial products. In this class, students should learn the types of lattice defects in crystals and their role on mechanical properties, and understand how crystalline materials develop their mechanical strength.

●Prerequisite Subjects

●Course Topics

1. Crystal structure and Miller index
2. Crystal defects
3. The ideal strength of crystals
4. Structure, energy and motion of dislocations
5. Plastic deformation of crystals
6. The effects of external factors on mechanical properties of crystals

●Textbook

There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading

●Grade Assessment

Evaluate the level of understanding by final examination.
Evaluation standard is understanding the basic concepts and ideas related to strength and plasticity of crystals.

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome during and after each lecture.

Soft matter physics (2.0credits) (ソフトマター物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Takashi UNEYAMA Associate Professor

●Course Purpose

Soft matters, such as polymers, rubbers, liquid crystals, and collids, exhibit characteristic physical properties which are much different from those of crystals and metals. This is due to the complex molecular structures of soft matters and/or various self-assembled order structures. Statistical mechanical methods to describe soft matters will be studied.The purpose of this lecture is to obtain the following skills:1. To explain the basic concepts and properties of various soft matters.2. To describe the physical properties of soft matters by utilizing the statistical mechanical methods.

●Prerequisite Subjects

Thermodynamics, Statistical Mechanics A and B

●Course Topics

1) Solutions and Colloid Dispersions2) Liquid Crystals3) Polymers4) Rubbers and GelsStudents are required to prepare for the lecture by reviewing related topics in statistical mechanics.

●Textbook

Documents will be provided following the lecture.

●Additional Reading

Masao Doi, "Soft-Matter Physics", Oxford University Press, 2013Ronald Larson, "The Structure and Rheology of Complex Fluids", Oxford University Press, 1998

●Grade Assessment

Only by the final exam (100%). Record more than 60/100 is qualified.The skills to explain the basic concepts and properties of various soft matters and to describe the physical properties of soft matters by utilizing the statistical mechanical methods are evaluated by the final exam.

●Notes

There is no requirements.

●Contacting Faculty

Questions are welcome within or after each lecture or exercise.

Seminar on Physical Science and Engineering (2.0credits) (物理工学セミナー)

Course Type	Specialized Courses	
Class Format	Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	3 Autumn Semester	
Elective/Compulsory	Compulsory Elective	
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose
Students learn how important Physical Science and Engineering is, from the lectures given by research groups in the department.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
(1)Outline of the department of physical engineering, research groups, and research fields
(2)Activities of the research groups

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

Passing grade: 60 points out of 100

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

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

Course Type	Specialized Courses	
Class Format	Experiment and Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring Semester	
Elective/Compulsory	Compulsory	
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose

Students are given individual issue for thesis, and do experiments and analyses of their topics.

●Prerequisite Subjects

Subjects related to the Department of Physical Engineering

●Course Topics

(1)Literature research and research plan formulation
(2)Theoretical analyses, experiments, calculation analyses and summary of them
(3)Discussion on research results
(4)Presentation of the research

●Textbook

There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading

There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment

Achievement will be evaluatred comprehensively baed on the research activities.
Acceptance criteria:
(1)Explaining the plan and significance of each research theme
(2)Summarizing the research results for specific problems
(3)Explaining their physical meaning

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

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

Course Type	Specialized Courses	
Class Format	Experiment and Exercise	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Autumn Semester	
Elective/Compulsory	Compulsory	
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose

Students are given individual issue for thesis, and do experiments and analyses of their topics.

●Prerequisite Subjects

Subjects related to the Department of Physical Engineering

●Course Topics

(1)Literature research and research plan formulation
(2)Theoretical analyses, experiments, calculation analyses and summary of them
(3)Discussion on research results
(4)Presentation of the research

●Textbook

There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading

There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment

Achievement will be evaluatred comprehensively baed on the research activities.
Acceptance criteria:
(1)Explaining the plan and significance of each research theme
(2)Summarizing the research results for specific problems
(3)Explaining their physical meaning

●Notes

There is no requirement for taking this class.

●Contacting Faculty

Questions are welcome within or after each lecture.

Selected Topics on Physical Science and Engineering 1a (1.0credits) (物理工学特別講義１ａ)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 1b (1.0credits) (物理工学特別講義１ｂ)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 1c (1.0credits) (物理工学特別講義１ｃ)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 1d (1.0credits) (物理工学特別講義１ｄ)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Engineering Ethics (2.0credits) (工学倫理)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Compulsory	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

All students will push forward the preparations to a member of society through a college life having high flexibility as well as the lecture of the university, but this is the conscious problem that it is independent and should work on. Therefore, about life, the responsibility of the necessary member of society (a person of occupation and researcher solving another person such as engineers and social problem situation), found ability, ethic, it is the purpose of the class that gets an image at the beginning of student life. I solved many problems until now, and the engineer developed the society, but had much failure, accidents and the ethical disgraceful affair. I understand basic power to act as a member of society, an engineer ethically while having the viewpoint to the future a little while referring to a lot of such failure examples. In addition, I acquire a custom to think on the spot, and to be settled necessary for an engineer, a member of society. (the lecturer is engaged in a study and the business of the engineer ethic in professional engineer (nation qualification) with the work experience.)

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Management Engineering (2.0credits) (経営工学)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering
	Department of Mechanical and Aerospace Engineering	Architecture	
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

[purpose of the class] In the corporate management, I learn it about the management of the technique that is essential for the growth, development and the innovation.
[arrival target] I become able to understand a way of thinking and the basics of management. I understand an organization change and an organization design, the management of the innovation and come to be able to give explanation.

●Prerequisite Subjects

●Course Topics

Management of technology (MOT) and knowledge management
Management and artefact (artifact)
Organization to realize innovation
Science, technique, sense of values
Innovation and organization learning

[instructions of the class overtime learning]
Preparing a next class range, and understanding the meanings of the technical term.

●Textbook

Isao Naito, Yukihiro Wakuta edition (2016) " organization theory of the representation" CHUOKEIZAI-SHA

●Additional Reading

Instructions will be given as necessary in class

●Grade Assessment

evaluation method] I give a small test to look back on the lecture content of the day before the end of the lecture of every time and have you finally submit a report. I evaluate it at 50% of normal points, report point 50%. In addition, I do not accept the submission of the report when there is absence more than 1/3.
[point of reference] Pass in understanding the basic concept and term in conjunction with the management engineering definitely; is based.

●Notes

There are no prerequisites

●Contacting Faculty

I accept questions during the class.

Industry and Economy (2.0credits) (産業と経済)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering
	Department of Mechanical and Aerospace Engineering	Civil Engineering	Architecture
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
Lecturer	Part-time Faculty		

●Course Purpose

I learn knowledge about the economy while examining the background, structure, influence about various economic phenomena, pocketbook issues.
I learn the economic thought method that economists built that understanding, explanation solves a pocketbook issue at the same time.

A target: In this lecture, a student attending a lecture aims for coming to be able to do the next thing.
1. As a member of society, an industrial person, I learn necessary and useful economic knowledge and come to be able to inflect.
2. I understand structure and the mechanism of the economic phenomenon, pocketbook issue and come to be thought systematically.
3. I understand the way of economic thought (view, way of thinking) and learn it and become able to inflect.

●Prerequisite Subjects

Because it is not a specialized subject, I do not appoint it in particular.

●Course Topics

1. Economic circulatory structure ... give-and-take
2. Change ... prosperous conditions and recession of the economy
3. Foreign exchange rate ... strong yen and weak yen
4. Role ... annual revenue and annual expenditure of the government
5. Maintenance of role ... price stability and the trust order of Bank of Japan
6. Problem ... overflow of population of the population and too few population
7. Economic history ... Smith and Keynes
8. Free-market economy ... light and shadow
9. Japanese economy ... inflation and deflation after World War II

Reading as I appoint the range that should read a textbook beforehand at the time of a lecture of every time for the next time.
In addition, reviewing it as I show a part to review and a method about the document which I distributed, and deepening understanding.

●Textbook

Nakaya"Nyumonsho wo yomumae no Keizaigaku nyumon",Doubunkan

●Additional Reading

P. A.Samuelson, W. D.Node house "economics" (Iwanami Shoten) Kennichi Miyazawa () "introduction to industrial linkage analysis" (Nikkei library, Nihon Keizai Shimbun, Inc.) Iwao Ozaki "industrial structure of Japan" (Keio University publication society)

R. A.I introduce it at the time of a lecture of every time including Feldman "economic latest lecture of the Dr. Feldman in Japan" (Bungeishunju Ltd.).

●Grade Assessment

Understand a basic concept about the economy definitely, and keep the structure of the pocketbook issue under control, and, in wearing an economic thought method, pass; is based. I evaluate an accomplishment degree by a small report (20%) to assign at the time of a lecture of every time and the regular examination (80%) of the term end and do higher than 60 points with a pass at one hundred perfect score. In addition, the absentee of the regular examination assumes it "absence".

●Notes

There are no prerequisites

●Contacting Faculty

Around during the lecture and lecture time, a charge teacher copes in a lecture room

General Electrical Engineering 1 (2.0credits) (電気工学通論第１)

Course Type	Related Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Spring Semester
Elective/Compulsory	Elective
Lecturer	Akimori TABATA Associate Professor

●Course Purpose

This course deals with fundamental of electrical circuit theory which is one of the most important subjects of electrical engineering.

The goals of this course are to
(1) be able to understand and explain the properties of electrical elements.
(2) be able to understand and explain circuit equations.
(3) be able to understand and explain steady-state and transient phenomena of electrical circuit.

●Prerequisite Subjects

Mathematics 1 with Exercises, Electromagnetics

●Course Topics

1. Circuit elements
2. Sinusoidal alternating current and electric power
3. Complex impedance and phasor
4. Circuit equations
5. Circuit Network theorem
6. Resonance circuits
7. Mutual induction circuits
8. Transient phenomena

●Textbook

●Additional Reading

●Grade Assessment

Examination. You must score 60% or more to pass the course.

●Notes

No requirement for the course.

●Contacting Faculty

E-mail: tabata@nuee.nagoya-u.ac.jp

General Electrical Engineering 2 (2.0credits) (電気工学通論第２)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering
Starts 1	4 Autumn Semester	3 Autumn Semester
Elective/Compulsory	Elective	Elective
Lecturer	TomokazuFUKUTSUKA Professor	

●Course Purpose
The aim of this course is to help students acquire the fundamental of secondary batteries such as lithium-ion batteries. At the end of the course, participants are expected to understand the electrochemistry for secondary batteries.

●Prerequisite Subjects
Fundamentals of Chemistry I, II

●Course Topics
1. Electrolysis cell, electrochemical system
2. Electrolyte solution
3. Electromotive force and electrode potential
4. Structure of electrode/electrolyte interface
5. Electrode reaction: charge-transfer process
6. Electrode reaction: diffusion process

●Textbook
Printed materials will be provided as needed.

●Additional Reading

●Grade Assessment
Your overall grade in the class will be decided based on the examination. Basic questions about the electrochemistry should be answered to pass.

●Notes
No course requirements

●Contacting Faculty
Contact by email.

Patent and Intellectual Property (1.0credits) (特許及び知的財産)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Physical Science and Engineering	Department of Energy Science and Engineering
	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering	Civil Engineering
	Architecture		
Starts 1	2 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester		
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective		
Lecturer	Masahiro KITO Professor		

●Course Purpose

Understand the necessity and significance of patents from the viewpoint of researchers and engineers at universities and companies

Acquire basic knowledge of patents and acquire what researchers and engineers who invent should do.

Attainment target

1. Understand the purpose and necessity of the patent system
2. Understand the basics of patent application procedures and how to write application documents
3. Can perform basic patent search
4. Understand how companies and universities use patents

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

Technical Visits in Industrial Plants (1.0credits) (工場見学)

Course Type	Related Specialized Courses	
Class Format	Practice	
Course Name	Department of Physical Science and Engineering	
Starts 1	3 Spring Semester	
Elective/Compulsory	Elective	
Lecturer	Associated Faculty	Associated Faculty

●Course Purpose
Students visit private companies or national laboratories relevant to physical science and engineering (PSE), and learn how PSE is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
It is rquired to visit each company or research institute and to do the following:
(1)Visiting research facilities in the companies and the laboratories
(2)Description of research content from researchers and engineers, and discussion on it

Submition of the reports are required.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on the submitted report.

(Evaluation criteria)
Understanding and explaining the specific application examples of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome during the class.

Physical Chemistry of Macromolecules (2.0credits) (高分子物理化学)

Course Type	Related Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	3 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Yuuichi MASUBUCHI Professor

●Course Purpose

[CAUTION: Because this course is newly designed for the new Engineering Physics course started from FY 2017, the contents are different from the lecture given in the Department of Engineering Chemistry.]

In this lecture course, what will be delivered are the basic physical properties of polymer solutions and solids regarding the molecular characteristics of polymer chains.

●Prerequisite Subjects

Thermodynamics and Statistical Physics

●Course Topics

The contents would be as listed below but may be changed or modified according to the reaction of the participants. Details of the calculations may be skipped due to the time limitation, and it is expected to be followed by the participants after the lecture. Besides, the participants are expected to think about the relation to our daily life.

1. Molecular Characteristics of Polymers
2. Properties of Polymers in Solution
3. Properties of Amorphous Polymers in Melt
4. Structures and Properties of Polymers in Solutions and in Bulk
5. Polymer structure (crystals, liquid crystals, transition)
6. Viscoelastic Properties and Dynamics of Polymers

●Textbook

No specific textbook is assigned to this course. If necessary, there are a lot of excellent books for polymer science as listed below.

●Additional Reading

P.J.Flory, "Principles of Polymer Chemistry" (Cornell University Press, New York, 1953)
P.G.deGenne, "Scaling Concepts in Polymer Physics" (Cornell University Press, New York, 1979)
M. Doi and S. F. Edwards, "The Theory of Polymer Dynamics" (Oxford University Press, Clarendon, 1983)

●Grade Assessment

The evaluation is based on the writing examination which will be at the end of the course.

●Notes

No specific condition

●Contacting Faculty

Raise your comments and questions during / after / before the lecture. Otherwise, you may come to the office of the lectuerer.

Intelligent Control System (2.0credits) (自動制御)

Course Type	Related Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Spring Semester
Elective/Compulsory	Elective
Lecturer	Shinji DOKI Professor

●Course Purpose

This series of lectures give the basic understanding and its implementation
for control various plants (for example, Electric circuit, Robot, Automobile and Chemical Plant) as you want.

Objective of this lecture
1. How to modeling and analysis the plant
2. How to design the controller for control it as you want

●Prerequisite Subjects

Linear Algebra I,II
Take the flolowing lectures is recommended for understanding examples of control plants.
>Fundamental of Physics I
>Electronics Circuits with Exercises
>Linear Circuits with Exercises
>Electric Power Apparatus

●Course Topics

1.State equations
2.Transfer functions
3.Frequency responses
4.Block diagrams
5.Stability analysis
6.Transient state characteristics
7.Steady state characteristics
8.Identification
9.Control system designs
10.System structures
11.Pole location

●Textbook

New interuniversity System and control Ohmsha

●Additional Reading

not used

●Grade Assessment

Examination score of 60% or more is necessary to pass the course.
S:90%-100%
A:80%-89%
B:70-79%
C:60-69%

●Notes

●Contacting Faculty

TEL ext.2778, Email doki@nagoya-u.jp

Introduction to Applied Nuclear Physics (2.0credits) (原子核工学概論)

Course Type	Related Specialized Courses
Class Format	Lecture
Course Name	Department of Physical Science and Engineering
Starts 1	4 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Yasuaki KOJIMA Associate Professor

●Course Purpose

This lecture covers nuclear fundamental properties, nuclear disintegration, radioactivity, stability of nuclei, nuclear structure, nuclear reaction and particle accelerator.
Aims:
1. Be able to understand explain nuclear properties such as decay, mass, nuclear models.
2. Be able to perform basic nuclear calculations such as reaction energies.
3. Be able to understand and explain experimental technique to measure nuclear properties.

●Prerequisite Subjects

Mechanics, Electromagnetics, Quantum Mechanics, Atomic Physics

●Course Topics

1. Radioactivity
2. Properties of atomic nuclei such as mass, binding energy, radius etc.
3. Alpha-decay, Beta-decay, Gamma-transition, internal conversion and fission
4. Nuclear model and magic number
5. Nuclear reactions

Exercises related to the contents of each lecture will be presented. Submit them as a report.

●Textbook

Textbooks are not specified, but lecture materials are distributed in each class.

●Additional Reading

Introduction to Nuclear Physics (in Japanese), author: Y. Sumi, published by SYOKABO.
Nuclear Physics (in Japanese), author: KAGEYAMA Seizaburo, published by ASAKURA-Syoten.
Nuclear Physics (in Japanese) by K. Yagi, ASAKURA-syoten.
Nuclear Physics (in Japanese) by T. Nagae and S. Nagamiya, SYOKABO.

●Grade Assessment

Grades will be evaluated by reports, midterm exams and final exams.
To pass, you must be able to explain basic properties of nucleus, and perform basic calculations on nuclear energies. If the more difficult problems can be handled, the grade is reflected accordingly.

●Notes

It is desirable to understand the contents of Mechanics, Electromagnetics, and Quantum Mechanics.

●Contacting Faculty

After the lecture, or e-mail.
mail: y-kojima@energy.nagoya-u.ac.jp
tel: 052-789-2572
Radioisotope Research Center, room number 218

Selected Topics on Physical Science and Engineering 2a (1.0credits) (物理工学特別講義２ａ)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 2b (1.0credits) (物理工学特別講義２ｂ)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 2c (1.0credits) (物理工学特別講義２ｃ)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Selected Topics on Physical Science and Engineering 2d (1.0credits) (物理工学特別講義２ｄ)

Course Type	Related Specialized Courses	
Class Format	Lecture	
Course Name	Department of Physical Science and Engineering	
Starts 1	4 Spring and Autumn Semester	
Elective/Compulsory	Elective	
Lecturer	Part-time Faculty	Part-time Faculty

●Course Purpose
Learning recent topics in physical science and engineering and how the basic knowledge is applied.

●Prerequisite Subjects
Subjects related to the Department of Physical Engineering

●Course Topics
A special lecture on physical science and engineering is given. The contents will be posetd on the bulletin board.

Submition of the reports are required. In addition, the keywords related to the research activities of each research group should be surveyed prior to the class.

●Textbook
There is no specific text book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Additional Reading
There is no specific reference book, but in some cases it may be specified by the lecturer or distributed depending on the content of the lesson.

●Grade Assessment
(Evaluation method)Evaluate the level of achievement for the target based on exmamination or the submitted report.

(Evaluation criteria)
Understanding and explaining the basic concepts and ideas related to the field of physical engineering.

●Notes
There is no requirement for taking this class.

●Contacting Faculty
Questions are welcome after each lecture. It is recommended to contact the lecturer in advance by e-mail.

Outline of Engineering 1 (1.0credits) (工学概論第１)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

Based upon the wide and deep experiences, alumini and/or aluminae of Nagoya University, who work the hub of society,give future perspectives, foster internal and external active personality and propose guideline for their further study.

●Prerequisite Subjects

Because it is a common subject not to affect a specialized subject, I do not appoint the subject to become the background.

●Course Topics

Experience every time own as "do your best younger student" a senior playing an active part in the social center I perform a class on the basis of this. In all eight times of classes, I perform orientation and the lecture by seven outside lecturers. What I check about a lecturer and a title released before a class of every time beforehand. After a lecture, conduct an additional investigation depending on the need including contents and the phrase handled in a lecture. In addition, submit it as you impose the report problem about lecture contents every time.

●Textbook

I distribute a slide or the print which the person in charge of each time lecturer uses as a lecture document.

●Additional Reading

Instructions will be given as necessary in class

●Grade Assessment

I evaluate an acquirement degree for the accomplishment by a report. I keep lecture contents of every time under control, and it is said that I pass if I can collect own thought and lets results reflect it according to the depth of the contents which were able to learn it such as the grasp of lecture contents, a guideline for the future dream, study of oneself.

●Notes

There are no prerequisites

●Contacting Faculty

I cope after a lecture every time. Or ask the staff of the educational affairs section.

Outline of Engineering 2 (1.0credits) (工学概論第２)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty		

●Course Purpose

In the world, the social formation of the low-carbon model becomes the problem in the face of the issue of global warming. I grasp a summary of the energy supply and demand of Japan by this lecture and am intended that I understand the trend of the energy saving and renewable energy technology and introduction promotion plan. In addition, I comment on "a basic engery plan" to become the guideline of the energy policy of our country.

●Prerequisite Subjects

●Course Topics

●Textbook

●Additional Reading

●Grade Assessment

●Notes

●Contacting Faculty

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

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	4 Autumn Semester
	4 Autumn Semester	4 Autumn Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Kiyohisa NISHIYAMA Lecturer	Emanuel LELEITO Lecturer	Gang ZENG Lecturer

●Course Purpose

This course will 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. The course will expose you to a wide range of issues being tackled by engineers in different fields, with the aim of motivating and preparing you to pursue your research interest. You will have an opportunity to explore basic concepts and real world applications, and to do a mini research tasks leading to a final presentation. Apart from the engineering field related knowledge, this lecture will also help you develop the following skills:
Cross-disciplinary Communication skills
Communication across language barriers (English/Japanese)
Online search and research skills for information gathering
Presentation skills

●Prerequisite Subjects

You do not require any background knowledge to join this class. Each lecturer will provide the basic knowledge that might be needed to understand the lecture topics.

●Course Topics

This class consists of “omnibus-style” lectures on the following 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.

Each lecturer will give you assignments to read in preparation for each of the lectures.

●Textbook

Lecture materials will be distributed in class during each lecture.

●Additional Reading

Lecture materials will be distributed in class during 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 a 3-5 minute video. 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 students are required to actively participate in class discussions, submit reports and presentations on time.

●Contacting Faculty

Questions are received during or after class time. Lecturers will provide contact information during class orientation.

Outline of Engineering 4 (3.0credits) (工学概論第４)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Chemistry and Biotechnology	Department of Materials Science and Engineering	Department of Physical Science and Engineering
	Department of Energy Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	1 Spring Semester
	1 Spring Semester	1 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Part-time Faculty	Yukio ISHIDA Designated Professor	

●Course Purpose

Elementary ClassThis course is intended to teach Japanese to students who have not learnt Japanese before or who have learned only a very little. Basic Japanese which is necessary for daily life in Japan will be taught.
The students study the fundamentals of grammar and basic conversational expressions. The students are requested to communicate in daily life using simple expressions.
Intermediate ClassThis course is intended to teach Japanese to students who already learned Japanese of Elementary level. The aims of this study are to obtain the ability necessary to explain their experiences concretely.
The students are requested to communicate in their study in Japanese. Depending on the students' Japanese ability, the advanced class will also be prepared.

●Prerequisite Subjects

Elementary ClassNone
Intermediate ClassElementary Japanese

●Course Topics

Elementary Class1.Pronunciation of Japanese 2.Structure of Japanese sentences 3.Fundamental vocabulary and expressions 4.Conversation practice 5.Listening practice, Students must read the part which they will study in the next lecture.
Intermediate Class1 Grammar, 2 Conversation, 3 Opinion delivery, 4 Reading comprehension, 5 Listening practice, The students must momorize the most important sentences which they will study in the next lecture.

●Textbook

Elementary ClassNIHONGO Breakthrough, From suruival to communication in Japanese, JAL Academy, ASK Publishing Co.Ltd.

Intermediate Classweekly J ： 6

●Additional Reading

I introduce it to progress appropriately

●Grade Assessment

Elementary ClassAttendance 20Class performance and assignments 20Interview test and examination30, Presentation 30
In each item (except attendance), the ability of comversation is an important check point.

Intermediate ClassAttendance 20Class performance and assignments 10Interview test 20Written examination20, Presentation 30.
In each item (except attendance), the ability of correct expressions is an important check point.
These scores are summed and evaluated. The students with the evaluation S, A, B, or C can pass this subject.

●Notes

This subject is open for NUSIP students.

●Contacting Faculty

Ext. 6797 ishida@nuem.nagoya-u.ac.jp

Statistics and Analysis B (2.0credits) (データ統計解析Ｂ)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Physical Science and Engineering	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering
	Civil Engineering	Architecture	
Starts 1	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	
Lecturer	Yoji YAMADA Professor	ShogoOKAMOTO Associate Professor	

●Course Purpose
In the first half of the course, we study the basic statistics with underlying mathematics for data analysis. In the second half of the course, we study a few representative multivariate analysis techniques. Through the analysis of actual data using these techniques, we are to attain insights into the mechanisms behind the data.

●Prerequisite Subjects
There is no specific requirement to enroll in this course.

●Course Topics
1. Probabilistic distribution- Random variable and probabilistic distribution function- Gaussian distribution and normalization2. Basis of statistics- Statistics representing data- Moment3. Statistic estimation and test- Sampling- Error and uncertainty- Estimation- Hypothesis test4. Correlation and regression- Statistic independence- Explanatory and objective variables- Linear regression equation5. Level of measurement6. Multiple regression analysis- Theory including generalized inverse matrix- Variable selection- Extension to nonlinear analysis- Presentation by students

●Textbook

●Additional Reading
Provided in the class accordingly.

●Grade Assessment
Homework (60%) and examination (40%). After this course, the students should be able to analyze their own data and reach some conclusions by themselves.

●Notes
Potential atendees are not required to have finished Data Statistics Analysis A.

●Contacting Faculty
It is preferred that questions are asked, solved, and shared with all the attendees during the class. Emails or direct visits with appointments are acceptable.- Prof. Yoji Yamada, yamada-yoji@mech.nagoya-u.ac.jp, Room 302 at 2nd eng. build.- Dr. Shogo Okamoto, okamoto-shogo@mech.nagoya-u.ac.jp, Room 305 at 2nd eng. build.

Technical Writing (2.0credits) (テクニカルライティング)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Department of Materials Science and Engineering	Department of Physical Science and Engineering	Department of Energy Science and Engineering
	Department of Electrical Engineering, Electronics, and Information Engineering	Department of Mechanical and Aerospace Engineering	Civil Engineering
	Architecture		
Starts 1	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester	4 Spring Semester	4 Spring Semester
	4 Spring Semester		
Elective/Compulsory	Elective	Elective	Elective
	Elective	Elective	Elective
	Elective		
Lecturer	Kiyohisa NISHIYAMA Lecturer	Gang ZENG Lecturer	Emanuel LELEITO Lecturer

●Course Purpose

This course is to learn the logical thinking and the method of expression for sending scientific and technical contents to others in English and learn how to apply these methods to technical writing and presentation in English.

What you will get in this course:
1. Understand logical thinking and structure issues.
2. Understand and write the document structure that leads to problem solving.
3. Write abstracts of scientific and technical papers in English.
4. Apply the above methods to presentations and debates in English.

●Prerequisite Subjects

This course will be taught from the basics, background subjects are not specified.

●Course Topics

1. Logical thinking
1.1 Logical thinking
1.2 Structuring logic
1.3 Problem Solving
2. Writing skill
2.1 Understanding document structure
2.2 Organizing document structure
2.3 Writing abstracts in English
3. Presentation skill
3.1 Creating slides in English
3.2 Presentation and Q & A in English
3.3 Discussion in English

Students are required to read related contents of next lecture in advance. Reports will be assigned after each lecture, which should be completed independently by searching necessary information. Reports and final presentation will be used for evaluation.

●Textbook

No textbook is specified. Lecture materials will be distributed in each class.

●Additional Reading

2019
2018
, 2016
A Manual for Writers of Research Papers, Theses, and Dissertations: Chicago Style for Students and Researchers (Chicago Guides to Writing, Editing, and Publishing) - Kate L. Turabian, Revised by Wayne C. Booth, Gregory G. Colomb, Joseph M. Williams, Joseph Bizup, William T. FitzGerald and the University of Chicago Press Editorial Staff.

●Grade Assessment

Evaluation will be conducted based on reports and final presentation. Credits will be awarded to those students who can write abstract and present idea using basic skills.

●Notes

No course requirements.

●Contacting Faculty

Questions will be accepted in the classroom after the lecture.