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

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

●Course Purpose

The aim of this tutorial is to deepen the understanding of calculus and to cultivate the ability to apply mathematical knowledge. The tutorial is mainly intended for students taking Calculus I.

●Prerequisite Subjects

Calculus I, G30 program

●Course Topics

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

●Textbook

No textbook is required for this tutorial.

●Additional Reading

No reference book is required for this tutorial.

●Grade Assessment

Your final grade will be determined by homework (40%) and quizzes (60%).

●Notes

●Contacting Faculty

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

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

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	1 Autumn Semester 1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective Elective	Elective	Elective
Lecturer	Erik Darpö Designated Associate Professor		

●Course Purpose

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

●Prerequisite Subjects

Linear Algebra I

●Course Topics

1. Geometric setting : points and vectors in Rn, located vectors in Rn, scalar product in Rn, norm and scalar product in Rn, parametric representation of a line, planes and hyperplanes. 2. Matrices and linear equations: matrices, homogeneous linear equations, row operations and Gauss elimination, elementary matrices. 3. Vector spaces: abstract definition, linear combinations, convex sets, linear independence, dimension, the rank of a matrix. 4. Linear maps: general maps, linear maps, kernel and range of linear maps, rank and linear maps, matrix associated with a linear map, composition of linear maps, inverse of a linear map.

●Textbook

Linear Algebra with Applications, fourth edition, Otto Bretscher, Edition: Pearson (can be borrowed in Central Library)

●Additional Reading

●Grade Assessment

Explained during the first class

●Notes

●Contacting Faculty

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

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	1 Autumn Semester 1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective Elective	Elective	Elective
Lecturer	Foong See KIT Designated Professor	Tsutomu KOUYAMA Professor	

●Course Purpose

This is a companion course to the lecture course Fundamentals of Physics I, and offers exercises to cultivate the ability to analyze and solve problems, as well as presentation and discussion skills so as to participate effectively in discussions among peers and instructors, leading to mastering the concepts introduced in the lecture.

●Prerequisite Subjects

Related CoursesCalculus I; Fundamental Physics I ; Fundamentals of Physics II

●Course Topics

See syllabus for Fundamentals of Physics I

●Textbook

Fundamentals of Physics Extended 9th Edition International Student Version with WileyPLUS Set (John Wiley & Sons, 2010ISBN:9780470576083)

●Additional Reading

●Grade Assessment

GradingAttendance and Class participation: 40%　Assignments and Quizzes: 60%Class attendance is required. Absentee must give a valid reason, supported with document. A student will receive an “Absent” grade if he is absent 2 or more times without valid reason.

●Notes

●Contacting Faculty

FOONG See KitOffice: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jpKOUYAMA TsutomuOffice: Science Hall 7F 723Phone: 052-789-5108Email:kouyama@bio.phys.nagoya-u.ac.jp

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

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	1 Autumn Semester 1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Elective Elective	Elective	Elective
Lecturer	Bernard GELLOZ Designated Professor	TAMA Florence Muriel Professor	

●Course Purpose

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

●Prerequisite Subjects

Related CoursesCalculus I; Fundamentals of Physics I ; Fundamentals of Physics II

●Course Topics

Course ContentsSee syllabus for Fundamental Physics II.

●Textbook

Fundamentals of Physics Extended 9th Edition International Student Version with WileyPLUS Set (John Wiley & Sons, 2010ISBN:9780470576083)

●Additional Reading

●Grade Assessment

GradingWeekly assignments; attendance; class participation. (Weighting to be advised.)Criteria for “Absent” & “Fail” Grades• Class attendance is required. Absentees must give a valid reason (e.g. doctor’s certificate). A student who is absent from more than 3 sessions will receive zero for the semester attendance mark.• The “Absent” grade is reserved for students who withdraw by November 16. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

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

Computer Software I (2.0credits) (計算機ソフトウェア１)

Course Type	Basic Specialized Courses		
Class Format	Lecture		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	1 Autumn Semester	1 Autumn Semester	1 Autumn Semester
Elective/Compulsory	Compulsory	Compulsory	Compulsory
Lecturer	Ichiro IDE Associate Professor		

●Course Purpose

The purpose of this course is to provide basic computer literacy skills and basic computer programming techniques for solving various problems in the C language through exercises.

●Prerequisite Subjects

Basic mathematics

●Course Topics

1. Basic computer literacy skills - Writing and sending e-mails - UNIX command line interface2. Basics of the C language - Data types and variables - Control structures (Selection, loop, etc.) - Functions - Standard C library functions (Input/Output, Math, etc.) - Fundamental data structures (Scalars, arrays, etc.)3. Problem Solving by Programming

●Textbook

K.N. King: "C Programming: A Modern Approach, 2nd Edition", W. W. Norton & Company, 2008 (ISBN: 978-0393979503)

●Additional Reading

●Grade Assessment

Grades will be based on weekly reports, class attendance, and several project reports. Students must obtain a score of 60 or higher to pass the course. Grades: S: 100-90, A: 89-80, B: 79-70, C: 69-60, F: 59-0.

●Notes

●Contacting Faculty

Students can communicate with their lecturer and TA during lecture hours or via email (cs1-16@murase.m.is.nagoya-u.ac.jp).

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

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

●Course Purpose

The aim of this tutorial is to deepen the understanding of calculus and to cultivate the ability to apply mathematical knowledge. The tutorial is mainly intended for students taking Calculus II.

●Prerequisite Subjects

Calculus II, G30 program

●Course Topics

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

●Textbook

No textbook is required for this tutorial.

●Additional Reading

No reference book is required for this tutorial.

●Grade Assessment

Your final grade will be determined by homework (40%) and quizzes (60%).

●Notes

●Contacting Faculty

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

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

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	1 Spring Semester 1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective Elective	Elective	Elective
Lecturer	Erik Darpö Designated Associate Professor		

●Course Purpose

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

●Prerequisite Subjects

Linear Algebra II

●Course Topics

See Linear Algebra II.

●Textbook

Linear Algebra with Applications, fourth edition, Otto Bretscher, Edition: Pearson (can be borrowed from the Central Library)

●Additional Reading

●Grade Assessment

Explained during the first class

●Notes

●Contacting Faculty

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

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	1 Spring Semester 1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Elective Elective	Compulsory	Elective
Lecturer	Bernard GELLOZ Designated Professor	Foong See KIT Designated Professor	John A. WOJDYLO Designated Associate Professor

●Course Purpose

The aims of this course are to deepen students' understanding of basic Physics of electricity and magnetism and to cultivate their ability to apply Physics knowledge.

●Prerequisite Subjects

Fundamentals of Physics

●Course Topics

1. Electric Charge and Electric Fields 2. Gauss' Law 3. Electric Potential 4. Capacitance, Current, Resistance and Circuits 5. Magnetic Fields 6. Induction and Inductance

●Textbook

Fundamentals of Physics David Halliday, Robert Resnick, Jearl Walker John Wiley & Sons Inc

●Additional Reading

●Grade Assessment

Class attendance is required. Absentee must give a valid reason.Class Attendance: 10%; Assignments, quizzes and other assessment (written, presentation, etc.): 90%

●Notes

●Contacting Faculty

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

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

●Course Purpose

The aims of this course are to deepen students' understanding of basic Physics of waves and optics, and to cultivate their ability to apply Physics knowledge.

●Prerequisite Subjects

Fundamentals of Physics

●Course Topics

1. Oscillations2. Introduction to Maxwell's Equations3. Waves4. Electromagnetic Waves5. Images 6. Interference & Diffraction

●Textbook

Fundamentals of Physics David Halliday, Robert Resnick, Jearl Walker John Wiley & Sons Inc

●Additional Reading

●Grade Assessment

Class attendance is required. Absentee must give a valid reason.Class Attendance: 10%; Assignments, quizzes and other written assessment: 90%.

●Notes

●Contacting Faculty

Fundamentals of Biology II (2.0credits) (生物学基礎２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	1 Spring Semester
Elective/Compulsory	Elective
Lecturer	Maria VASSILEVA Designated Associate Professor

●Course Purpose

This course`s main goal is to provide students with working understanding on how human body functions and the ability to use this knowledge in everyday health-related situations. The course focuses on human anatomy and physiology, but also on how organ systems' organization has changed throughout animals' evolution. Short introduction is given on plant morphology and physiology, as well as on basic concepts of ecology. The overview of plants and interactions of ecological systems will allow students to critically evaluate agricultural and ecological issues.

●Prerequisite Subjects

There is no prerequisite knowledge for this course, so even those who didn't take Fundamentals of Biology 1, or didn't study Biology in high school, are welcome to join and learn how human body works.

●Course Topics

1. Animals1.1 Unifying concepts of animal structure and function1.2 Nutrition and digestion1.3 Gas exchange1.4 Circulation1.5 The immune system1.6 Control of body temperature and water balance1.7 Hormones and the endocrine system1.8 Reproduction and embryonic development1.9 Nervous system1.10 The senses1.11 How animals move2. Plants2.1 Plant structure, growth and reproduction2.2 Plant nutrition and transport2.3 Control systems in plants 3. Ecology3.1 The biosphere: an introduction to Earth`s diverse environments3.2 Behavioral adaptations to the environment3.3 Population ecology3.4 Communities and ecosystems3.5 Conservation biology

●Textbook

The same textbook will be used as in Fundamentals of Biology 1Campbell Biology: Concepts & Connections, 7th Ed.Jane B. Reece / Martha R. Taylor / Eric J. Simon / Jean L. DickeyBenjamin Cummings, 2011Mastering Biology (www.masteringbio.com) is an online system that accompanies the textbook for this course. Course login details will be given at the first lecture. This system will not be integrated into the course assessment methods. The choice of using it will be left to each individual student.

●Additional Reading

●Grade Assessment

Evaluation will be based on in-class participation (total of 20% of the final grade) and two exams (total of 80% for both). Attendance will not be marked.In-class participation will consist of active participation in discussions and quality of presentations and in-group assignments. There will be no periodic home works or quizzes; instead students are expected to read the appropriate chapter before class, as classes will include problem-solving questions and discussions. Exams will emphasize on analytical and problem-solving questions.

●Notes

●Contacting Faculty

VASSILEVA MariaOffice : School of Science, building E, room 202Phone : 789-3530E-mail : mnvassileva@bio.nagoya-u.ac.jp

Mathematics I and Tutorial (3.0credits) (数学１及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	2 Autumn Semester	2 Autumn Semester	2 Autumn Semester
Elective/Compulsory	Compulsory	Compulsory	Compulsory
Lecturer	John A. WOJDYLO Designated Associate Professor	Shinya MATSUZAKI Designated Assistant Professor	

●Course Purpose

5th period

This course is a companion course to Mathematical Physics II. This course introduces first order and second order ordinary differential equations and their solution methods. Students master analytical techniques for problems that arise in physics, engineering and chemistry. Questions of uniqueness of solutions and convergence are also discussed. Students are also introduced to Fourier series, the Fourier transform, convolution, Laplace transform, and the Dirac delta function. Students will find this mathematical methods course helpful in other units such as Quantum Mechanics, Analytical Mechanics, Electricity and Magnetism, as well as in Automotive Engineering and other engineering courses.

This course has dual aims: 1) to convey mathematical principles; 2) to improve students' technical ability – i.e. ability to express intuition in mathematical terms and ability to solve problems.

4th period

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

●Prerequisite Subjects

Prerequisites

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

Related Courses

Mathematical Physics Tutorial I, Mathematical Physics II

●Course Topics

Course Outline

• First order ordinary differential equation (ODE) initial value problems. Integration factor; separable equations; systems of ODEs (Hamiltonian systems); phase plane, flow. Uniqueness and existence theorems. Some differences between linear and nonlinear ODEs.

• Second order linear ODE initial value problems. Homogeneous solution. Proving linear independence (Wronskian). Method of Undetermined Coefficients; Variation of Parameters. Series solutions: ordinary point, regular singular point; convergence tests; Method of Frobenius. Examples from physics, engineering and chemistry.

• Fourier series. Dirichlet conditions. Role of symmetry. Gibbs phenomenon. Effect of jump discontinuity on speed of convergence. Integration and differentiation of Fourier series.

• Fourier transform, convolution, Dirac delta function. Laplace transform.

●Textbook

4th period

None

5th period

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

●Additional Reading

4th period

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

(Copies are available in the library.)

5th period

1. Boyce W., DiPrima R, Elementary Differential Equations, 9th or 10th Ed., Wiley.
2. Strang, G., Introduction to Linear Algebra, 4th Edition, Chapter 6.
3. Riley K.F., Hobson M.P., and Bence S. J., 2006, Mathematical Methods for Physics and Engineering, 3rd ed., Cambridge University Press.
4. Boas M.L., 1983, Mathematical Methods in the Physical Sciences, John Wiley & Sons.

Arfken G.B. & Weber H.J., 2005, Mathematical Methods for Physicists, 6th ed., Elsevier Academic Press.

(Copies are available in the library.)

●Grade Assessment

4th period

tutorial Attendance: 50%; Class performance: 50%

5th period

Attendance: 5%; Weekly Quizzes and Assignments: 25%; Mid-term exam: 35%; Final Exam: 35%

●Notes

●Contacting Faculty

4th period

Office: ES Building, ES747

Phone: 052-789-5043

Email: synya@hken.phys.nagoya-u.ac.jp

5th period

Office: Science Hall 5F 517

Phone: 052-789-2307

Email: john.wojdylo@s.phys.nagoya-u.ac.jp

Mathematics II and Tutorial (3.0credits) (数学２及び演習)

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	2 Autumn Semester	2 Autumn Semester	2 Autumn Semester
Elective/Compulsory	Compulsory	Compulsory	Compulsory
Lecturer	TakaakiFUJITA Professor		

●Course Purpose

Building on the mathematics and physics knowledge gained in Fundamental Major Subjects, this course introduces students to vector analysis and partial differential equations, expecting their applications to advanced engineering, such as those related to mechanics and electromagnetics, and those to materials and heat transfer phenomena. The purpose of the course is to acquire fundamental knowledge in vector analysis and partial differential equations and enable students to apply it to solve actual engineering issues through intensive exercises.

●Prerequisite Subjects

Fundamental Major Subjects: physics and mathematics courses

●Course Topics

1. Orientation of the course 2. Vector algebra
3. Vector differential operations
4. Curved lines and curved surfaces 5. Gradient, divergence and rotation
6. Vector integration; line integrals, surface integrals and volume integrals
7. Gauss theorem, Green's theorem and Stokes theorem
8. Irrotational (conservative) field and solenoidal field
9. Curvilinear coordinate systems
10. Concept of partial differential equations
11. Laplace equation, diffusion equation and wave equation
12. Separation of variables 13. Use of Fourier series
14. Poisson's equation and Green function

●Textbook

TBA

●Additional Reading

Mathematical Methods for Physicists, sixth edition, by G. B. Arfken and H. J. Weber,
Elesevier, 2005 (ISBN: 0-12-088584-0)
Mathematical Methods in the Physical Sciences, by Mary L. Boas,
Wiley, 2006 ((ISBN: 978-0471198260)

●Grade Assessment

Attendance: (20%)
Reports: (30%)
Examinations: (50%)
Students need to obtain at least 60% of the total marks to pass the course.

●Notes

●Contacting Faculty

Office: Bld. No. 8 south, Room No. 407,
Phone: 052-789-4593,
E-mail : fujita@ees.nagoya-u.ac.jp

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

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	Fundamental and Applied Physics
Starts 1	2 Autumn Semester	2 Autumn Semester
Elective/Compulsory	Elective	Compulsory
Lecturer	Foong See KIT Designated Professor	

●Course Purpose

Course PurposeThis is the first of two Year II courses in analytical mechanics. Its purpose is to gain a deeper understanding of Newtonian mechanics treated in Year I, and to introduce the Lagrangian and Hamiltonian formulations of mechanics. These formulations are then used in the solution of the two-body central force problems. Comparisons will be made between the approaches.

●Prerequisite Subjects

Calculus I, Calculus II, Fundamentals of Physics I &IIRelated CoursesPhysics Tutorial Ia, Mathematical Physics I & II, Analytical Mechanics II, Quantum Mechanics I &II

●Course Topics

Course Contents1. Newton’s Laws of Motion 2. Momentum and Angular Momentum 3. Energy and Forces 4. Calculus of Variations5. Lagrange’s Equations6. Hamiltonian Mechanics7. Two Body Central-Force Problems

●Textbook

John R. Taylor, Classical Mechanics (University Science Book, 2005)

●Additional Reading

These reference books are available in the Main Library1. R. D. Gregory: Classical Mechanics (Cambridge, 2008)2. J.B. Marion: Classical Dynamics of Particles and Systems (Academic Press, 1965) 3. G. R. Fowles: Analytical Mechanics (1962) 4. H. Goldstein, Poole & Safko, Classical Mechanics (Addison Wesley, 2002)

●Grade Assessment

GradingClass Attendance & Participation: 10%, Assignment: 20%, Tests: 30%, Final Exam: 40% Class attendance is required. Absentee must give a valid reason, supported with document. A student will receive an “Absent” grade if he is absent from lecture more than 3 times or he is absent without valid reason from the mid-term exam or final exam.

●Notes

●Contacting Faculty

Office: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jp

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

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	Fundamental and Applied Physics
Starts 1	2 Autumn Semester	2 Autumn Semester
Elective/Compulsory	Elective	Compulsory
Lecturer	Fujio TAKIMOTO Designated Professor	

●Course Purpose

The purpose of Statistical Physics I is to understand the basic laws that govern macroscopic bodies consisting of an enormous number of atoms and molecules. This first part of the course covers universal phenomenological laws, called thermodynamic laws, and their applications.

The main focus of this course is to understand the basic principles of classical thermodynamics which are the basis for macroscopic understanding of all the physical phenomena. The applications in automotive engineering are also introduced.

●Prerequisite Subjects

Calculus

●Course Topics

1.Thermal Equilibrium and Temperature
2.State Equations, Partial Differentials, Units and Dimensions
3.The First Law of Thermodynamics (energy, isothermal and adiabatic processes)
4.The Second Law of Thermodynamics
5.Entropy
6.Thermodynamic Functions
7.Phase Equilibrium and Chemical Equilibrium
8.Kinetic Theory and Statistical Mechanics

●Textbook

Printed handouts will be provided.

●Additional Reading

Modern Engineering Thermodynamics; Robert T. Balmer; Academic Press (2010)

●Grade Assessment

Grades will be based on class participation, assignments and a final examination.

30% for attendance
30% for assignments
40% for final examination

●Notes

●Contacting Faculty

Students can ask questions at any time during classes.
Questoins during off-class hours can be asked at the lecturer's room (Engineering Building No.3 North Wing, Room 223 (3125)) or via e-mail: takimotof@nuem.nagoya-u.ac.jp

Physics Tutorial Ia (0.5credits) (物理学演習１ａ)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	2 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Makoto KUWAHARA Associate Professor

●Course Purpose

To support the lecture course of Analytical Mechanics I.
To gain a deeper understanding about Analytical Mechanics I.
To cultivate the ability to analyze and solve problems through solving problems assigned in the lecture.
To cultivate discussion skills so as to participate effectively in tutorial discussions among peers and instructor.

●Prerequisite Subjects

Related Courses
Analytical Mechanics I

●Course Topics

Students learn to apply the principles and methods taught in the lecture to analyze and solve problems under the guidance of the instructor, and to participate actively in class discussions. Students are required to hand in regular assignments.

●Textbook

John R. Taylor, Classical Mechanics (University Science Book, 2005)

●Additional Reading

These reference books are available in the Main Library
1. H. Goldstein, Poole & Safko, Classical Mechanics (Addison Wesley, 2002)
2. R. D. Gregory: Classical Mechanics (Cambridge, 2008)
3. J.B. Marion, Classical Dynamics of Particles and Systems (Academic Press, 1965)
4. G. R. Fowles: Analytical Mechanics (1962)

●Grade Assessment

Grading: Assignment 50%, Class Participation: 30%, Final Exam: 20%
Criteria for “Absent” & “Fail” Grades: Class attendance is required. Absentee must give a valid reason. A student will receive an “Absent” grade if he is absent from class more than 2 times or he is absent without valid reason from the Final Exam. A student who is NOT “Absent” but wishes to receive an “Absent” grade must see the instructor immediately after the Final Exam.

●Notes

●Contacting Faculty

KUWAHARA Makoto
Office: Eng. Bldg.3, room 453
Phone: 052-789-3597
Email: kuwahara@imass.nagoya-u.ac.jp

Physics Tutorial Ib (0.5credits) (物理学演習１ｂ)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	2 Autumn Semester
Elective/Compulsory	Elective
Lecturer	Fujio TAKIMOTO Designated Professor

●Course Purpose
The purpose of this course is to deepen students' understanding of thermodynamics/statistical physics 1, and cultivate their calculation skills by solving basic problems

●Prerequisite Subjects
Calculus

●Course Topics
Students will solve the basic problems under faculty guidance.

1.Thermal Equilibrium and Temperature
2.State Equations, Partial Differentials, Units and Dimensions
3.The First Law of Thermodynamics (energy, isothermal and adiabatic processes)
4.The Second Law of Thermodynamics
5.Entropy
6.Thermodynamic Functions
7.Phase Equilibrium and Chemical Equilibrium
8.Kinetic Theory and Statistical Mech

●Textbook
Printed handouts will be provided.

●Additional Reading
Modern Engineering Thermodynamics; Robert T. Balmer; Academic Press (2010)

●Grade Assessment
Grades will be based on participation, assignments, and a final examination.

30% for attendance
30% for assignments
40% for final examination

●Notes

●Contacting Faculty
Students can ask questions at any time during classes.
Questoins during off-class hours can be asked at the lecturer's room (Engineering Building No.3 North Wing, Room 223
(3125)) or via e-mail: takimotof@nuem.nagoya-u.ac.jp

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

Course Type	Basic Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	Fundamental and Applied Physics
Starts 1	2 Autumn Semester	2 Autumn Semester
Elective/Compulsory	Compulsory	Elective
Lecturer	Peter BUTKO Designated Professor	

●Course Purpose

The purpose of this course is to learn what physical chemistry is all about and to grasp important principles and facts about physical chemistry. The course begins with perfect gas law, proceeds to thermodynamics, and finishes with applications of thermodynamics to simple mixtures.

●Prerequisite Subjects

Fundamentals of Chemistry I and II

●Course Topics

1 The Properties of Gases 1 (Ch. 1)
2 The Properties of Gases 2 (Ch. 1)
3 The First Law 1 (Ch. 2)
4 The First Law 2 (Ch. 2)
5 Pre-exam Review & EXAM 1 (Chs. 1 & 2)
6 The Second and Third Laws 1 (Ch. 3)
7 The Second and Third Laws 2 (Ch. 3)
8 Physical Transformations of Pure Substances (Ch. 4)
9 Simple Mixtures 1 (Ch. 5)
10 Simple Mixtures 2 (Ch. 5)
11 Pre-exam Review & EXAM 2 (Chs. 3 – 5)
12 Chemical Equilibrium 1 (Ch. 6)
13 Chemical Equilibrium 2 (Ch. 6)
14 Pre-final Review
15 FINAL EXAM (Ch. 1 – 6)

●Textbook

P. Atkins and J. de Paula: Atkins' Physical Chemistry, 10th Ed., Oxford University Press, 2014

●Additional Reading

●Grade Assessment

Two exams: 100 points each, final exam (comprehensive): 200, homework: 50. TOTAL: 450.
Grade "S": 100-90% (405 or more points), "A": 89-80% (404 - 360 pts), "B": 79-70% (359 - 315 pts), "C": 69-60% (314 - 270 pts), "F": 59-0% (fewer than 270 pts).The "Absent" grade is reserved for students that withdraw by the 6th lecture period. After that day, a letter grade will be awarded based on grades earned from all assignments during the semester.
It is essential to sit in each exam during the scheduled class time. There will be NO make-up exam. In the event of a missed exam due to a serious illness, accident or family emergency, compelling written documentation of the reason for the absence will be required. If the reason is accepted, the final grade will be calculated from the appropriately weighted average from the rest of the exams. If the reason will be deemed insufficient, the absence will be unexcused, and zero points will be awarded for the missed exam.

●Notes

●Contacting Faculty

Office: SA Building-318-1 (Science & Agriculture)
Phone: 789-2480

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

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

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

●Course Purpose

Course PurposeThis course offers a solid introduction to electrostatics and magnetostatics. It introduces fundamental mathematical methods required to solve problems in physics, engineering and applied mathematics. This course has dual aims: 1) to convey physical principles; 2) to improve students' technical ability – i.e. ability to express physical intuition in mathematical terms and ability to solve problems.

●Prerequisite Subjects

Calculus I&II; Fundamentals of Physics III&IV; Mathematical Physics II or Consent of Instructor.Physics Tutorial IIa

●Course Topics

Course Contents• Revision of vector calculus, curvilinear coordinates, Dirac Delta Function.• Electrostatics. Coulomb's Law. Continuous Charge Distributions. Divergence and Curl of Electrostatic Fields. Field Lines, Flux, and Gauss's Law. Electric Potential. Poisson's Equation and Laplace's Equation. The Potential of a Localized Charge Distribution. Work and Energy in Electrostatics. Conductors. Induced Charges. Surface Charge and the Force on a Conductor. • Special Techniques. The Method of Images: point charge near a conducting plane or sphere, grounded or insulated. Separation of Variables.• Electric Fields in Matter. Polarization. Dielectrics. The Electric Displacement. Linear Dielectrics. • Magnetostatics. The Lorentz Force Law. The Biot-Savart Law. The Divergence and Curl of B. Applications of Ampere's Law. Magnetic Vector Potential A. What is "real", A or B?• Magnetic Fields in Matter. Magnetization. Diamagnetism, Paramagnetism, Ferromagnetism. The Auxiliary Field H. Magnetic Susceptibility and Permeability. • Introduction to Electrodynamics. Electromotive Force. Electromagnetic Induction. Faraday's Law. Energy in Magnetic Fields. Maxwell's Equations. Magnetic levitation above a superconductor.

●Textbook

Griffiths, D.L., 2012, Introduction to Electrodynamics, 4th ed., Prentice Hall. (It is essential that students read this book.)

●Additional Reading

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

●Grade Assessment

Attendance: 5%; Weekly quizzes or other written assessment: 15%; Mid-term exam: 40%; Final Exam: 40% The "Absent" grade is reserved for students who withdraw by May 16. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

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

Quantum Mechanics I (2.0credits) (量子力学１)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Peter BUTKO Designated Professor

●Course Purpose

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

●Prerequisite Subjects

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

●Course Topics

1 From Classical to Quantum Mechanics (Ch. 1)2 Wave Packets and the Schrodinger Equation (Ch. 2)3 The Quantum Mechanical Postulates (Ch. 3)4 Pre-exam Review & EXAM 1 (Ch. 1 – 3)5 The Particle in the Box 1 (Ch. 4)6 The Particle in the Box 2 (Ch. 5)7 Commuting and Non-commuting Operators and the Uncertainty Principle (Ch. 6)8 Harmonic Oscillator: Classical and Quantum Mechanical 1 (Ch. 7)9 Harmonic Oscillator: Classical and Quantum Mechanical 2 (Ch. 7)10 Pre-exam Review & EXAM 2 (Ch. 4 – 7)11 The Vibrational and Rotational Spectroscopy of Diatomic Molecules 1 (Ch. 8)12 The Vibrational and Rotational Spectroscopy of Diatomic Molecules 2 (Ch. 8)13 The Hydrogen Atom (Ch. 9)14 Pre-final Review15 FINAL EXAM (Ch. 1 – 9)

●Textbook

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

●Additional Reading

●Grade Assessment

Two exams: 100 points each, final exam (comprehensive): 200, homework: 50. TOTAL: 450.Grade "S": 100-90% (405 or more points), "A": 89-80% (404 - 360 pts), "B": 79-70% (359 - 315 pts), "C": 69-60% (314 - 270 pts), "F": 59-0% (fewer than 270 pts).The “Absent” grade is reserved for students that withdraw by May 23, 2014. After that day, a letter grade will be awarded based on grades earned from all assignments throughout the semester.

●Notes

●Contacting Faculty

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

Analytical Mechanics II (2.0credits) (解析力学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Elective
Lecturer	Foong See KIT Designated Professor

●Course Purpose

Course PurposeTo treat further topics in mechanics: the use of non-inertial frames, particularly on the use of the rotating frame to analyze mechanics problems (such as the Foucault pendulum) on the rotating earth, the motion of rigid bodies with a focus on the motion of a spinning top, and collision theory leading to the celebrated Rutherford scattering formula that supported his atomic model. In the latter one-third of the course, special relativity will be introduced.

●Prerequisite Subjects

Analytical Mechanics I, Mathematical Physics I, and Mathematical Physics IIPhysics Tutorial IIb, Quantum Mechanics II

●Course Topics

1. Mechanics in Non-Inertial Frames 2. Rotational Motion of Rigid Bodies3. Introduction to Collision Theory4. Special Relativity

●Textbook

John R. Taylor, Classical Mechanics (University Science Book, 2005)

●Additional Reading

These reference books are available in the Main Library1. R. D. Gregory: Classical Mechanics (Cambridge, 2008)2. J.B. Marion: Classical Dynamics of Particles and Systems (Academic Press, 1965) 3. G. R. Fowles: Analytical Mechanics (1962) 4. H. Goldstein, Poole & Safko, Classical Mechanics (Addison Wesley, 2002)

●Grade Assessment

Class Participation: 10%, Assignment: 10%, Exam I: 48%, Exam II: 32%Class attendance is required. Absentee must give a valid reason, supported with document. A student will receive an “Absent” grade if he is absent from lecture more than 3 times or he is absent without valid reason from the mid-term exam or final exam.

●Notes

●Contacting Faculty

FOONG See KitOffice: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jpSUZUKI Takeru Ken Office: ES-611e-mail: stakeru@nagoya-u.jp

Applied Physics Laboratory I (1.0credits) (応用物理学実験１)

Course Type	Basic Specialized Courses
Class Format	Experiment
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

The course consists of a minimum set of basic experiments on applied physics. Through the experiments, students acquire basic experimental techniques and deepen understandings of the experimental research.

●Prerequisite Subjects

●Course Topics

Following the orientation and a first lecture on experimental data processing, students will be divided in groups of two or three students and conduct one experiment per week on the topics listed below. Assistant professors offer tutorials for each experiment. At the final week, students make their oral presentations about the last experiment.

1. Optical fibers,
2. Stefan-Boltzmann 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. Vacuum,
10. Sound-velocity of ultrasonic pulse

●Textbook

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

●Additional Reading

●Grade Assessment

Grades will be based on the attendance on the experiments, the report on data processing, all the reports on individual topics, and the presentation. Students must obtain a score of 60/100 or higher to pass the course. Delayed submission of reports will affect the applicable grade.

●Notes

●Contacting Faculty

Statistical Physics II (2.0credits) (統計物理学２)

Course Type	Basic Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	John A. WOJDYLO Designated Associate Professor

●Course Purpose

Course PurposeAfter learning the structure of thermodynamics and why thermodynamics works, students are introduced to the basic laws, from the microscopic viewpoint, that govern macroscopic bodies consisting of a very large number of particles. Applications are considered in condensed matter physics, solid state physics, cosmology, chemistry, materials science and biology.

●Prerequisite Subjects

Calculus I; Calculus II; or Consent of InstructorPhysics Tutorial III, Statistical Physics III

●Course Topics

Course Outline• Review of Equilibrium Thermodynamics. The problem and the postulates. Fundamental Relation in the energy and entropy representations. Conditions of equilibrium. Obtaining the Fundamental Relation from the Equations of State: exact and inexact differential equations. Euler Equation. Gibbs-Duhem Relation. Electromagnetic radiation and the equation of state of the photon gas. Reversible processes and the Maximum Work Theorem: Carnot cycle. Legendre transformation and thermodynamic potentials. Extremum principle in the Legendre transformed representations. Maxwell Relations: all thermodynamic experimental information is encoded in the slopes and curvatures of the Fundamental Relation. The three basic experimental quantities.• Statistical Mechanics. Basic concepts in probability and statistics. Learning to count. Statistical mechanics in the entropy representation: microcanonical formalism. Temperature and the Boltzmann factor. Equilibrium conditions: the Boltzmann definition of entropy behaves as it should. The Einstein model of a crystalline solid. The “two-state model” and the Schottky Hump. A polymer model: rubber band. Counting techniques: high dimensionality. Some number-theoretical and combinatorial concepts: partitions of integers. • Statistical Mechanics in the Helmholtz Representation: Canonical formalism. Canonical partition function. Additivity of energies and factorizability of the partition function. Internal modes in a gas. Probabilities in factorizable systems. Statistical mechanics of small systems: ensembles. • The classical density of states. Classical ideal gas. High temperature properties: Equipartition Theorem.• Kinetic theory of dilute gases in equilibrium. Maxwell-Boltzmann distribution.

●Textbook

1. Callen, H., Thermodynamics and an Introduction to Thermostatistics, 2nd ed.,Wiley, 1985. (The central textbook in this course. Japanese translation has fewer typographical errors.) 2. Blundell, S. and Blundell, K., Concepts in Thermal Physics, 2nd Ed., Oxford University Press, 2010. (Good, elementary explanations. Many copies available in the library.)3. Reif, F., Fundamentals of Statistical and Thermal Physics, McGraw-Hill, 1965.

●Additional Reading

1. Zemansky, M.W. and Dittman, R.H., Heat and Thermodynamics, An Intermediate Textbook, McGraw-Hill, 1992. (Excellent for empirical basis of thermodynamics; somewhat advanced.)2. Kittel, C. and Kroemer, H., Thermal Physics, W.H. Freeman.3. Landau, L.D. and Lifshitz, E.M., Statistical Physics, Part I, by E.M. Lifshitz and L.P. Pitaevskii, Pergamon Press. (A classic book: thorough, advanced treatment.)4. Kubo, R., Thermodynamics, Wiley.5. Kubo, R., Statistical Mechanics, Wiley.

●Grade Assessment

Grading Attendance: 5%; Weekly quizzes or other written assessment: 15%; Midterm exam: 40%; Final Exam: 40% The “Absent” grade is reserved for students who withdraw by November 16. After that day, a

letter grade will be awarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

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

Applied Physics Tutorial II (2.0credits) (応用物理学演習２)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Masaaki Araidai Assistant Professor　Makio UWAHA Professor

●Course Purpose

Course PurposeThis is a companion course to Quantum Mechanics II and Statistical Physics II, and offers practical exercises for mastering the concepts introduced in the lecture courses.

●Prerequisite Subjects

●Course Topics

See syllabi for Quantum Mechanics II and Statistical Physics II.

●Textbook

●Additional Reading

●Grade Assessment

GradingWeekly assignments (40 %); attendance (30 %); class participation (30 %).Class attendance is required. A student will be regarded as ABSENT if he/she is absent from lecture more than 3 times without valid reason.Student can withdraw the course by the regular procedure set by University.

●Notes

●Contacting Faculty

Office: Science Hall 6F 611, Phone: 052-789-2874Email: uwaha@nagoya-u.jp

Applied Physics Tutorial III (1.5credits) (応用物理学演習３)

Course Type	Basic Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

The purpose of these tutorials is to support the Electricity and Magnetism lecture course. This course offers a solid introduction to electrostatics and magnetostatics. It also introduces fundamental mathematical methods required to solve problems in physics, engineering and applied mathematics.

●Prerequisite Subjects

Electricity and Magnetism

●Course Topics

Students will be assigned problems on the following: • Vector calculus, curvilinear coordinates, Dirac Delta Function.• Electrostatics. Coulomb's Law. Continuous Charge Distributions. Divergence and Curl of Electrostatic Fields. Field Lines, Flux, and Gauss's Law. Electric Potential. Poisson's Equation and Laplace's Equation. The Potential of a Localized Charge Distribution. Work and Energy in Electrostatics. Conductors. Induced Charges. Surface Charge and the Force on a Conductor. • Special Techniques. The Method of Images. Separation of Variables.• Electric Fields in Matter. Polarization. Dielectrics. The Electric Displacement. Linear Dielectrics. • Magnetostatics. The Lorentz Force Law. The Biot-Savart Law. The Divergence and Curl of B. Applications of Ampere's Law. Magnetic Vector Potential. • Magnetic Fields in Matter. Magnetization. Diamagnets, Paramagnets, Ferromagnets. The Auxiliary Field H. Magnetic Susceptibility and Permeability. • Introduction to Electrodynamics. Electromotive Force. Electromagnetic Induction. Faraday's Law. Energy in Magnetic Fields. Maxwell's Equations.

●Textbook

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

●Additional Reading

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

●Grade Assessment

Students must submit assignments and obtain a score of 60/100 or higher to pass this tutorial course.

●Notes

●Contacting Faculty

Students are encouraged to ask questions and discuss problems in this class.

Computer Software II (2.0credits) (計算機ソフトウェア２)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	1 Spring Semester	1 Spring Semester	1 Spring Semester
Elective/Compulsory	Compulsory	Elective	Compulsory
Lecturer	YosukeWATANABE Designated Associate Professor		

●Course Purpose

Building on the knowledge gained in Computer Software 1, students will acquire advanced programming skills through C-programming exercises. Advanced programming includes functions, arrays, string operations, structures, I/O, pointers, complex data structures, and large-scale programming. In the latter part of the course, students will acquire the skills to create practical large-scale programs utilizing several advanced programming tools.

●Prerequisite Subjects

Computer Software 1

●Course Topics

1. Review of Computer Software 12. Pointers3. Pointers and Arrays4. Strings5. Input/Output 6. Writing Large Programs7. Structures, Unions and Enumerations8. Advanced Uses of Pointers9. The Preprocessor, Declarations10. Programming project I11. Programming project II12. Programming project III13. Programming project IV14. Programming project V15. Programming project VI

●Textbook

K N King. C Programming: A Modern Approach. 2nd ed.

●Additional Reading

●Grade Assessment

Homework assignments : 50% Programming projects : 50% Students must obtain a score of 60 or higher to pass the course.

●Notes

●Contacting Faculty

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

Mechanics of Continuous Media (2.0credits) (連続体物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	TakashiISHIHARA Associate Professor

●Course Purpose

The purpose of this course is to gain an understanding of the basic idea underlying macroscopic view of the mechanics of continuous media, particularly fluid mechanics. Emphasis is placed on the conservation laws of mass and momentum, and on how to use these in practice. Course objectives include the followings;(1) understanding basic concepts underlying the mechanics of continuous media(2) the acquisition of calculus skills(3) understanding the idea of the macroscopic view.

●Prerequisite Subjects

●Course Topics

1. Fluid motion (Eulerian/Lagrangian description, stream line, particle path),2. Fluid property (Newtonian Fluid, ideal fluid, stress, rate of strain tensor), 3. Basic equations (conservation of mass, momentum and energy), 4. Motion of ideal fluid (Euler eq., Bernoulli's theorem), 5. Two-dimensional incompressible and irrtational flow (stream function, complex velocity potential), 6. Water wave (hydrostatic pressure, deep water wave, wave of infinitesimal amplitude), 7. Vortex motion (Helmholtz' vortex theorem), 8. Motion of viscous fluid (Navier-Stokes eq.), 9. Mechanics of elastic bodies (basic eq.)

●Textbook

●Additional Reading

●Grade Assessment

Examination: 60%Report 40%. Students must obtain a score of 60/100 or higher to pass the course.

●Notes

●Contacting Faculty

Biophysics (2.0credits) (生物物理学)

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

●Course Purpose

To understand the basics of biophysics, in which biological phenomena are described in terms of physics language.

●Prerequisite Subjects

Preferrably, Fundamentals of Physics I, II, III, and IV.

●Course Topics

Course Contents1. Brief history of biophysics 2. Biomolecules – amino acids and proteins3. Biomolecules – nucleic acids 4. Biomolecules – lipids and membranes5. Central dogma of molecular biology 6. Protein folding and salvation effects7. Asakura-Oosawa theory of depletion forces8. Protein unfolding (denaturation) at high temperature and by denaturants9. Cold denaturation of proteins 10. Protein unfolding at high pressure11. Computer simulations of protein folding and unfolding

●Textbook

●Additional Reading

●Grade Assessment

GradingEvaluation will be based on attendance and reports (take-home exams).Criteria for “Absent” & “Fail” GradesClass attendance is required. Absentee must give a valid reason. A student will be regarded as ABSENT if he/she is absent from lecture more than 3 times or he/she is absent without valid reason from the final exam. A student who is NOT ABSENT but wishes to be considered as ABSENT must see the instructor immediately after the final exam.

●Notes

●Contacting Faculty

Office: Science Hall 5F 510, Phone: 052-789-3528Email: okamoto@phys.nagoya-u.ac.jp

Astrophysics (2.0credits) (宇宙物理学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Elective
Lecturer	TsutomuTAKEUCHI Associate Professor

●Course Purpose

Course PurposeTo understand the hierarchy of the universe and the evolution of the universe based on classical mechanics, thermodynamics, statistical physics, electromagnetism, atomic physics, nuclear physics, relativity, and quantum mechanics.

●Prerequisite Subjects

Basic physics (mechanics, electrodynamics)

●Course Topics

Course Contents1. Hierarchy of the universe2. Basic Astrophysical Concepts3. Our Solar System: Sun and Planets4. Stars and Interstellar Medium5. The Milky Way Galaxy6. Galaxies in the Universe 7. The evolution of galaxies8. Cluster of galaxies and the large-scale structure9. Cosmic microwave background radiation and Big Bang10. Big Bang Nucleosynthesis and beyond11. Cosmic inflation12. The history of the Universe

●Textbook

Material will be distributed during the courses.

●Additional Reading

An Introduction to Modern Astrophysics, Second Edition (Bradley W. Carol & Dale A. Ostlie, 2006, Benjamin Cummings)

●Grade Assessment

Evaluated by report(s)Absent: if you are absent more than a half of the lectures. Fail: if you do not submit reports, or the quality of the reports is too low.

●Notes

●Contacting Faculty

TAKEUCHI TsutomuE-mail: takeuchi.tsutomu@g.mbox.nagoya-u.ac.jpINUTSUKA Shu-ichiroE-mail: inutsuka@nagoya-u.jp

Fluid Mechanics and Tutorial (2.5credits) (流体力学及び演習)

Course Type	Specialized Courses
Class Format	Lecture and Exercise
Course Name	Fundamental and Applied Physics
Starts 1	2 Spring Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Fujio TAKIMOTO Designated Professor

●Course Purpose

The purpose of this course is to understand the fundamental characteristics of fluid motions applied to many areas of fluid mechanics and learn the physical laws governing them.
Students will:
(1) understand the properties, basic principles, and concepts of fluids.
(2) learn about the basic equations derived from above, i.e. continuity equation, motion equation, and energy equation, and be able to use them in calculations, and
(3) comprehend the aspects and properties of fluids conceptually utilizing the engineering observations of practical examples.

●Prerequisite Subjects

Calculus
Thermodynamics

●Course Topics

1. Properties of Fluid
2. Flow around bodies
3. Thermodynamics of fluid
4. Basic equations of fluid mechanics

Students will solve problems under faculty guidance.

●Textbook

Printed handouts will bbe provided.

●Additional Reading

Fluid Mechanics; Robert A. Granger; Dover Publications (1995)

●Grade Assessment

Grades will be based on class participation, assignments and a final examination.

30% for attendance
30% for assignments
40% for final examination

●Notes

●Contacting Faculty

Students can ask questions at any time during classes.

Questoins during off-class hours can be asked at the lecturer's room (Engineering Building No.3 North Wing, Room 223 (3125)) or via e-mail: takimotof@nuem.nagoya-u.ac.jp

Quantum Mechanics II (2.0credits) (量子力学２)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	John A. WOJDYLO Designated Associate Professor

●Course Purpose

Course Purpose: Building on the foundations developed in the first course, this course introduces further concepts and methods in quantum mechanics in order to describe the detailed structure of an atom and its interaction with the electromagnetic field.

●Prerequisite Subjects

Quantum Mechanics I, Mathematical Physics I, and Mathematical Physics IIPhysics Tutorial III, Analytical Mechanics I & II, and Electricity& Magnetism

●Course Topics

Course Contents1. Operator methods in quantum mechanics2. Angular momentum3. Spin 4. Time-independent perturbation theory5. The real hydrogen atom - fine structure and anomalous Zeeman effect6. Identical particles and Pauli exclusion principle7. Ground state and excited states of Helium atom8. Time-dependent perturbation theory and emission and absorption of radiation by an atom

●Textbook

Stephen Gasiorowicz: Quantum Physics, 3rd Ed. (Wiley, 2003)

●Additional Reading

1. David Griffiths, Introduction to Quantum Mechanics, 2nd Ed. (Pearson, 2005)2. T. Engel: Quantum Chemistry and Spectroscopy, 2nd Ed. (Prentice Hall, 2010)

●Grade Assessment

Grading: Class Attendance and Participation: 10%　Mid-term exam: 30%　Final Exam: 60% Criteria for “Absent” & “Fail” GradesClass attendance is required. Absentee must give a valid reason, supported with document. A student will receive an “Absent” grade if he is absent from lecture more than 3 times or he is absent without valid reason from the mid-term exam or final exam.

●Notes

●Contacting Faculty

Office: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jp

Applied Physics Laboratory II (2.0credits) (応用物理学実験２)

Course Type	Specialized Courses
Class Format	Experiment
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

This course introduces 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

Applied Physics Laboratory I

●Course Topics

Applied Physics Laboratory II and Applied Physics Laboratory III are offered subsequently over the course of one year. Following the orientation, students will be divided in groups of 3-7 students and conduct experiments at each laboratory. Assistant professors will offer tutorials for each experiment.

1. MOS integrated circuits
2. Michelson interferometry, Luminescence of semiconductor
3. X-ray diffraction
4. Reflection high energy electron diffraction
5. Metallurgical physics, Magnetic properties
6. Measurements of thermal expansion of solid materials: Effects of lattice vibration and magnetic phase transition on thermal expansion
7. Electrons as particles and waves/ Diffraction and imaging of photons
8. Magnetic resonance, conductivity measurements

●Textbook

Textbooks for each experiment will be distributed at each research laboratory and each experiment will be guided by an assistant professor. Students should bring their own experimental notebook, graph paper, and a scientific calculator to the laboratory.

●Additional Reading

●Grade Assessment

Grades will be based on the attendance on the experiments and all the reports for each experiment. Students must obtain a score of 60/100 or higher to pass the course. Delayed submission of reports will affect the applicable grades.

●Notes

●Contacting Faculty

Applied Physics Seminar (2.0credits) (応用物理学セミナー)

Course Type	Specialized Courses
Class Format	Seminar
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

The purpose of this class is to deepen the understanding of the role of fundamental physics in modern technology by discussing various subjects in the field of applied physics.

●Prerequisite Subjects

Mathematics, Analytical Mechanics, Electricity and Magnetism, Quantum Mechanics, Statistical Physics

●Course Topics

This is a seminar course; a student takes the course offered in a laboratory. Each student is expected to make presentations about various subjects in the field of applied physics. Appropriate reference books or papers will be designated during the course. Understanding should be further strengethened through discussions among participants following the presentations.

●Textbook

To be announced.

●Additional Reading

●Grade Assessment

Presentation, activity in the discussion and report. Students must obtain a score of 60/100 or higher to pass the course.

●Notes

●Contacting Faculty

Optics (2.0credits) (物理光学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Hideo KISHIDA Professor

●Course Purpose

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

Outcomes:
1. The ability to explain the reflection, refraction and propagation of light on basis of the knowledge of electomagnetic 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

Electricity and Magnetism, Mathematics

●Course Topics

1. Electromagnetic waves and polarization of light
Maxwell equations, Fresnel's equations, Polarized lights, Electrooptical-effects, Optical rotation and Faraday effect

2. Spectroscopy
Cavity radiation, Dual nature of light, Lorentz model, Dispersion and absorption

3. Light emission and laser
Spontaneous emission and stimulated emission, Luminescence, Laser oscillation,
Nonlinear optical effects

●Textbook

●Additional Reading

●Grade Assessment

Grades are detemined based on examination and quizzes (reports).
Pass mark 60/100

●Notes

●Contacting Faculty

Students are encouraged to make questions after the lecture.

Condensed Matter Physics I (2.0credits) (物性物理学１)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Bernard GELLOZ Designated Professor

●Course Purpose

The goal of this course is to learn about the fundamental theories related to the behavior of electrons and atoms in solids and about the mechanism of some of the most important properties solids exhibits, including electrical, thermal, mechanical and magnetic properties.

●Prerequisite Subjects

●Course Topics

1. Solid, Liquid, Gas Phase2. Crystal Structure and Periodic Structure3. Bravais Lattices; Famous Crystal Structures4. Typical Symmetry Elements5. Real Space and Reciprocal Space6. X-ray diffraction; Bragg Condition; Laue Function7. Brillouin zone8. Crystal Structure Factor9. Structure Determination by X-ray diffraction10. Elastic properties of solids and elastic strains

●Textbook

Introduction to Solid State Physics (IE), 8th EditionKittel, Charles/ McEuen, Paul.John Wiley & Sons Inc 2005.(12,015)

●Additional Reading

Ashcroft&Mermin: Solid State Physics (Brooks/Cole) Price: ~$60P. Hofmann: Solid State Physics, an introduction (Wiley-VCH) Price: ~$40

●Grade Assessment

Gradeswill be based on homework, a midterm examination and a final examination

●Notes

●Contacting Faculty

Chemical Physics (2.0credits) (化学物理学)

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

●Course Purpose

Course PurposeTo learn physical basis of chemical phenomena such as phase and chemical equilibrium, and chemical kinetics. Advanced topics will be shown depending on the progress.

●Prerequisite Subjects

●Course Topics

Course Contents1. Review of basic thermodynamics2. Thermodynamics of multi-component systems3. Chemical equilibrium4. Phase equilibrium5. Chemical kinetics6. Advanced topics

●Textbook

1. Donald A. McQuarrie, John D. Simon Physical Chemistry: A Molecular Approach, Univ Science Books
2. Charles R. Cantor, Paul R. Schimmel Biophysical Chemistry (Pt. I-III), W H Freeman & Co

●Additional Reading

●Grade Assessment

Evaluation will be based on a report.The “Absent” grade is reserved for students that withdraw.

●Notes

●Contacting Faculty

Computational Chemistry (2.0credits) (計算化学)

Course Type	Specialized Courses	
Class Format	Lecture	
Course Name	Chemistry	Fundamental and Applied Physics
Starts 1	3 Autumn Semester	3 Autumn Semester
Elective/Compulsory	Elective	Compulsory
Lecturer	Stephan IRLE Professor	

●Course Purpose

“How can computers help with chemistry?” The purpose of this course is to introduce computer science from a chemist’s perspective. The course begins with an introduction to the basic use of computers for data search and molecular structure and spectroscopic visualization, and introduces FORTRAN 90 as a way to solve simple scientific problems in an efficient way.

●Prerequisite Subjects

Mechanics, Statistical Mechanics

●Course Topics

Course Contents
1. Using the computer: Searching for information
2. Constructing and viewing 3-dimensional models of molecules: GaussView, MOLDEN programs
3. Overview over commercial molecular modeling packages
4. Introduction to FORTRAN 90: Compilers, etc.
5. Data Types, Constants, and Variables
6. If, else if, case expressions
7. Do loops
8. Functions and subprograms
9. Application: Data processing and visualization using GNUplot
10. Molecular dynamics simulations

●Textbook

Larry Nyhoff, Sanford Leestma: Introduction to FORTRAN 90 (Japanese version available)

●Additional Reading

●Grade Assessment

By submitting assignments

●Notes

●Contacting Faculty

Office: SA Building-424 (Science & Agriculture)
Phone: 747-6397
E-mail: sirle@chem.nagoya-u.ac.jp

Scientific Measurements (2.0credits) (計測工学)

Course Type	Specialized Courses		
Class Format	Lecture		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	3 Autumn Semester	3 Autumn Semester	3 Autumn Semester
Elective/Compulsory	Elective	Elective	Compulsory
Lecturer	Tsuyoshi UCHIYAMA Associate Professor	Kiichi NIITSU Lecturer	

●Course Purpose

In generally science and measurement are closely correlated and product technologies have been developed with developing measurement technologies. The purpose of the course is to develop an understanding of the fundamentals of measurement systems, including sensor devices and signal processing circuits.

●Prerequisite Subjects

Electronics, Electrical circuit

●Course Topics

1. Outline (systematization of measurement etc.)2. Operation principle of sensing elements3Signal detection and conversion4Signal processing

●Textbook

●Additional Reading

●Grade Assessment

Report Credits will be awarded to those students who score 60 or more. Grades are as follows:S:100-90, A:89-80, B:79-70, C:69-60, F:59-0.

●Notes

●Contacting Faculty

Questions are accepted after each lecture at the class room or in the office by appointment. To T. Uchiyama, call ext.3617 or e-mail to tutiyama@nuee.nagoya-u.ac.jp To K. Niitsu, call ext.2794 or e-mail to niitsu@nuee.nagoya-u.ac.jp

Fluid Mechanics (2.0credits) (流体力学)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Autumn Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Fujio TAKIMOTO Designated Professor

●Course Purpose

The purpose of this course is to understand the fundamental characteristics of fluid motions applied to many areas of fluid mechanics and learn the physical laws governing them.
Students will:
(1) understand the properties, basic principles, and concepts of fluids.
(2) learn about the basic equations derived from above, i.e. continuity equation, motion equation, and energy equation, and be able to use them in calculations, and
(3) comprehend the aspects and properties of fluids conceptually utilizing the engineering observations of practical examples.

●Prerequisite Subjects

Calculus
Thermodynamics, Elementary fluid mechanics/dynamics

●Course Topics

1.Vortex, circulation and integral of motion equation
2.Flow of incompressible non-viscous fluid
3.Flow of viscous fluid
4.Flow of compressible fluid

●Textbook

Printed handouts will be provided.

●Additional Reading

Fluid Mechanics; Robert A. Granger; Dover Publications (1995)

●Grade Assessment

Grades will be based on class participation, assignments and a final examination.

30% for attendance
30% for assignments
40% for final examination

●Notes

●Contacting Faculty

Students can ask questions at any time during classes.
Questoins during off-class hours can be asked at the lecturer's room (Engineering Building No.3 North Wing, Room 223 (3125)) or via e-mail: takimotof@nuem.nagoya-u.ac.jp

Statistical Physics III (2.0credits) (統計物理学３)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	John A. WOJDYLO Designated Associate Professor

●Course Purpose

Course PurposeStudents learn quantum statistics of ideal gases, the statistical mechanics of systems of interacting particles and introductory theory of phase transitions and critical phenomena. Applications are considered in condensed matter physics, solid state physics, cosmology, chemistry, materials science and biology.

●Prerequisite Subjects

Statistical Physics II; or Consent of InstructorPhysics Tutorial IV

●Course Topics

Detailed Course Outline. Some topics are covered in tutorial assignments. Statistical mechanics.• Quantum states of a single particle. Periodic boundary conditions, reflecting boundary conditions. Density of states in 3, 2 and 1 dimensions, for linear and quadratic dispersion relations. • Systems with varying number of particles: the Grand Canonical ensemble and partition function. • The quantum distribution functions: photon statistics Planck distribution; Fermi-Dirac statistics Fermi distribution; Bose-Einstein statistics Bose distribution; Maxwell-Boltzmann statistics Maxwell-Boltzmann distribution. Size of the relative dispersion. The classical limit: characterizations in terms of fugacity and mean occupation number; thermal wavelength and the quantum-classical crossover. • Black body radiation: energy density, radiation pressure, Stefan-Boltzmann Law and Wien Displacement Law.• The ideal Fermi fluid: conduction electrons in metals. Fermi energy, mean energy, specific heat in 3D, 2D, 1D.• The ideal Bose fluid: Bose-Einstein condensation in 3D. What about in 2D or 1D? Critical temperature. Mean energy, specific heat. The possibility of BEC in a photon gas. Breakdown of the Grand Canonical description.• Systems of interacting particles. A basic strategy for dealing with the complication of interactions. The Debye Model of solids. The specific heats of metals and insulators have the same temperature dependence: why? Weakly nonideal gases: virial expansion. Derivation of the Van der Waals equation of state for a non-ideal gas, and for a fluid using a self-consistent mean field approach. Thermodynamics and an introduction to advanced concepts. • Stability of thermodynamic systems. Concavity/convexity of thermodynamic potentials. Le Chatelier’s Principle. First Order phase transitions, features of the free energy. Discontinuity in the entropy: latent heat. Slope of the coexistence curves: Clapeyron Equation. Van der Waals fluid, unstable isotherms, physical isotherm, Maxwell equal-area rule. Multicomponent systems: Gibbs phase rule. Phase diagrams.• Critical phenomena. Continuous phase transition. Thermodynamics in the neighbourhood of the critical point. Divergence and stability. Order parameter and critical exponents ,,,. Classical theory in the critical region: Landau Theory. Example: paramagnetism versus ferromagnetism; Ising model, exact solution of zero-field 1D case and mean field theory solution. Why classical theory fails (qualitative). The “scaling hypothesis”. Why universality classes exist (qualitative) and examples of mapping of one problem into another.• Fluctuations. Probability distribution of fluctuations. Moments and energy fluctuations. Correlation moments. Explanation of critical opalescence.• The idea of renormalization group theory and a simple sample calculation. (If time permits.)

●Textbook

1. Callen, Herbert, Thermodynamics and an Introduction to Thermostatistics, 2nd Ed., Wiley. (The Japanese translation has fewer misprints.)2. Reif, F., Fundamentals of Statistical and Thermal Physics, McGraw-Hill, 1965.3. Cardy, J., Scaling and renormalization in statistical physics, Cambridge University Press, 1996.

●Additional Reading

1. Kittel, C. and Kroemer, H., Thermal Physics, W.H. Freeman.2. Huang, K., Statistical Mechanics, Wiley.

●Grade Assessment

Grading Attendance: 5%; Weekly quizzes or other written assessment: 15%; Mid-term exam: 40%; Final Exam: 40% Criteria for “Absent” & “Fail” GradesThe “Absent” grade is reserved for students who withdraw by May 16. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

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

Applied Physics Tutorial IV a (1.0credits) (応用物理学演習４ａ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

The purpose of these tutorials is to support the quantum mechanics lecture course. This course offers a solid introduction to quantum mechanics. It also introduces fundamental mathematical methods required to solve problems in quantum mechanics.

●Prerequisite Subjects

quantum mechanics, mechanics, mathematics

●Course Topics

Students will be assigned problems on the following:• Wave–particle duality of the elementary particle.• Schrodinger equation.• Copenhagen interpretation of the wave function.• Symmetry and conservation law.

●Textbook

Modern Quantum Mechanics (J. J. Sakurai)

●Additional Reading

●Grade Assessment

Students must submit assignments and obtain a score of 60/100 or higher to pass this tutorial course.

●Notes

●Contacting Faculty

Students are encouraged to ask questions and discuss problems in this class.

Applied Physics Tutorial IV b (1.0credits) (応用物理学演習４ｂ)

Course Type	Specialized Courses
Class Format	Exercise
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory Elective
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

Course PurposeThe purpose of this course is to cultivate students' calculation skills and deepen their understanding of statistical physics.

●Prerequisite Subjects

PrerequisiteStatistical Physics I, IIRelated CoursesStatistical Physics III

●Course Topics

Course ContentsStudents learn to apply the principles and methods taught in the lecture to analyze and solve problems under the guidance of the instructor. Strongly recommended to participate actively in the class discussion. Students are required to hand in regular weekly assignments.

●Textbook

None

●Additional Reading

Federick Reif, Fundamentals of statistical and thermal physics, McGraw-Hill (1985)Herbert B. Callen, Thermodynamics and an introduction to thermostatistics, Wiley (1985)

●Grade Assessment

GradingEvaluation will be based on the assignment and the class participation.Criteria for "Absent" & "Fail" GradesClass attendance is required. Absentee must give a valid reason. A student will receive an "Absent" grade if he/she is absent from class more than 2 times without valid reason.

●Notes

●Contacting Faculty

Office: Science & Agricultural Building SA306Phone: 052-789-5105Email: okazaki.ryuji@cc.nagoya-u.ac.jp

Applied Physics Laboratory III (2.0credits) (応用物理学実験３)

Course Type	Specialized Courses
Class Format	Experiment
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Faculty of Fundamental and Applied Physics

●Course Purpose

This course introduces 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

Applied Physics Laboratory I

●Course Topics

Applied Physics Laboratory II and Applied Physics Laboratory III are offered subsequently over the course of one year. Following the orientation, students will be divided in groups of 3-7 students and conduct experiments at each laboratory. Assistant professors will offer tutorials for each experiment.

1. MOS integrated circuits
2. Michelson interferometry, Luminescence of semiconductor
3. X-ray diffraction
4. Reflection high energy electron diffraction
5. Metallurgical physics, Magnetic properties
6. Measurements of thermal expansion of solid materials: Effects of lattice vibration and magnetic phase transition on thermal expansion
7. Electrons as particles and waves/ Diffraction and imaging of photons
8. Magnetic resonance, conductivity measurements

●Textbook

Textbooks for each experiment will be distributed at each research laboratory, and each experiment will be guided by an assistant professor. Students should bring their own experimental notebook, graph paper, and a scientific calculator to the laboratory.

●Additional Reading

●Grade Assessment

Grades will be based on the attendance on the experiments and all the reports for each experiment. Students must obtain a score of 60/100 or higher to pass the course. Delayed submission of reports will affect the applicable grades.

●Notes

●Contacting Faculty

Quantum Mechanics III (2.0credits) (量子力学3)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory Elective
Lecturer	John A. WOJDYLO Designated Associate Professor

●Course Purpose

Course PurposeBuilding on Quantum Mechanics 2, students will learn quantum mechanics at an advanced undergraduate level. The course will build physical intuition of Hilbert space and Nature on the quantum scale while improving students' ability to express physical intuition in mathematical terms and to solve problems. Students will be adequately prepared with regards to their knowledge of quantum mechanics to undertake further studies in S-lab, E-lab, V-lab, R-lab, TB-lab and other labs in both the Department of Physics and Department of Applied Physics at Nagoya University. Students from other disciplines, such as chemistry, can also benefit from the deep treatment of quantum phenomena.

●Prerequisite Subjects

Quantum Mechanics 2 or Consent of Instructor.• Students must have passed Quantum Mechanics 2 to take Quantum Mechanics 3.• Students should read the book by Susskind and Friedman before the start of semester.

●Course Topics

Course Contents• Why is quantum mechanics necessary? How does Nature behave on the quantum scale?• Mathematical introduction. Review of classical mechanics. The postulates of quantum mechanics. The classical limit.• The harmonic oscillator. The Heisenberg Uncertainty relations. Systems with N degrees of freedom. • Symmetries and their consequences. Rotational invariance and angular momentum. The hydrogen atom. Spin. Addition of angular momentum. • Variational and WKB methods. Time-independent perturbation theory. Scattering theory. • Path integral formulation of quantum mechanics.

●Textbook

1. Shankar, R., 1994, Principles of Quantum Mechanics, 2nd ed., Kluwer Academic/Plenum. 2. Susskind, L. and Friedman, A., 2014, Quantum Mechanics: The Theoretical Minimum, Basic Books.(It is essential that students read these two books. The latter is particularly well written and simple to understand, containing in simple terms many of the points treated in a more sophisticated way in the book by Shankar.)

●Additional Reading

1. Feynman, R.P., Leighton, R.B., Sands, M., 2011, Feynman Lectures on Physics (Volume 3), Basic Books. (Highly recommended alternative reading – slightly dated – with simple explanations and deep insights.)2. Gottfried, K. and Yan, T.-M., 2004, Quantum Mechanics: Fundamentals, Springer. (Most of this book is too hard for undergraduates, but two chapters are at the right level, superb and relevant to this course.)3. Kreyszig, E., 1989, Introductory Functional Analysis with Applications, Wiley Classics.(Clear introduction to infinite dimensional Hilbert space, inner product spaces, spectral theory of linear operators, self-adjoint linear operators, etc. Read this if you want to clear up some maths concepts encountered in Shankar.)4. Landau, L. and Lifshitz, E., 1981, Quantum Mechanics Non-Relativistic Theory, Third Edition: Volume 3 (Course of Theoretical Physics), Butterworth-Heinemann. (Not for the novice; deep insights.)

●Grade Assessment

Grading Attendance: 5%; Weekly quizzes or other written assessment: 15%; Mid-term exam: 40%; Final Exam: 40%Criteria for "Absent" & "Fail" GradesThe "Absent" grade is reserved for students who withdraw by May 16. After that day, a letter grade will be awarded based on marks earned from all assessment during the semester.

●Notes

●Contacting Faculty

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

Condensed Matter Physics II (2.0credits) (物性物理学２)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	3 Spring Semester
Elective/Compulsory	Compulsory
Lecturer	Bernard GELLOZ Designated Professor

●Course Purpose

The goal of this course is to learn about the fundamental theories related to the behavior of electrons and atoms in solids and about the mechanism of some of the most important properties solids exhibits, including electrical, thermal, and mechanical properties.

●Prerequisite Subjects

●Course Topics

1. Lattice vibrations; Phonons2. Heat capacity of solids - Classical theory3. Heat capacity of solids - Einstein model and Debye model4. Thermal conductivity of solids5. Introduction to electron theory of metals; Drude model6. Free electron model: quantum approach; Fermi sphere7. Concept of energy bands8. Fermi-Dirac distribution function9. Electronic specific heat10. Semiconductors11. Dielectric properties of solids

●Textbook

Introduction to Solid State Physics (IE), 8th EditionKittel, Charles/ McEuen, PaulJohn Wiley & Sons Inc. 2005(12,015)

●Additional Reading

Ashcroft&Mermin: Solid State Physics (Brooks/Cole) Price: ~$60P. Hofmann: Solid State Physics, an introduction (Wiley-VCH) Price: ~$40

●Grade Assessment

Grades will be based on homework, a midterm examination and a final examination.

●Notes

●Contacting Faculty

Applied Physics Tutorial V (1.5credits) (応用物理学演習５)

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

●Course Purpose

The purposes of this course are to deepen students’ understanding of basic physics of Electromagnetism and Applied Mathematics, and to cultivate their ability to apply knowledge of Physics through the exercises on Electromagnetism and Applied Mathematics.

●Prerequisite Subjects

Fundamentals of Physics III, Electricity and Magnetism, Mathematics I and Tutorial, Mathematics II and Tutorial

●Course Topics

Solve exercises on the following: Electromagnetism:1. Mathematical fundamentals2. Gauge transformations3. Multipole expansion4. Laplace and Poisson equations5. The method of images6. Electromagnetic waves7. WaveguideApplied Mathematics:1. Matrices2. Calculus (Partial differentiation, Multiple integrals, and so on)3. Vector algebra4. Complex variables5. Fourier series and Fourier transformsThe teacher may modify the content depending on the students' background.

●Textbook

Exercises will be provided in class.

●Additional Reading

To be designated.

●Grade Assessment

Students must submit assignments and obtain a score of 60/100 or higher to pass this tutorial course.

●Notes

●Contacting Faculty

Students are encouraged to ask questions and discuss problems in this class.

Condensed Matter Physics III (2.0credits) (物性物理学３)

Course Type	Specialized Courses
Class Format	Lecture
Course Name	Fundamental and Applied Physics
Starts 1	4 Autumn Semester
Elective/Compulsory	Compulsory
Lecturer	Ichiro TERASAKI Professor

●Course Purpose

The purpose of this course is to show the students cutting-edge research in condensed-matter physics and to motivate them to study this rich and fertile research area. This course also aims at reviewing fundamental physics such as electromagnetism, statistical physics, and quantum mechanics through various aspects of advanced materials. Each lecture is covered by a different professor, and the students can grasp various research frontiers throughout the course.

●Prerequisite Subjects

Condensed-Matter Physics I, II

●Course Topics

1.TERASAKI, Ichiro: Introduction to Solid State Physics 3 and a little quiz for prerequisites 2. MIYAZAKI, Kuni: Theoretical Physics of Foods, Gels, Glasses, and All That 3. SATO, Noriaki Kensho: Introduction to Heavy-Fermion Physics 4. KOHNO, Hiroshi: The Uses of Spin: From Fundamentals to Spintronics 5. WADA, Nobuo, Introduction to Bose-Einstein Condensation 6. UWAHA, Makio, Chirality and Crystallization 7. ITOH, Masayuki, Magnetism and Superconductivity 8. MIURA, Yuichi: Exchange Interaction in Quantum Solid 9. KONTANI, Hiroshi: Superconductivity in Strongly Correlated Electron Systems 10. TERASAKI, Ichiro: Introduction to Thermoelecrtricity 11. KOBAYASHI, Yoshiaki, Study of Strongly Correlated Electron System by NMR and Neutron Diffraction Measurements 12. KOBAYASHI, Akito: Massless Dirac Fermions in Condensed Matter Physics 13. TANIGUCHI, Hiroki: Fundamentals and Applications of Ferroelectricity

●Textbook

None

●Additional Reading

None

●Grade Assessment

Grades will be based on attendance and reports.The “Absent” grade is reserved for students who withdraw by the deadline designated by the University. Class attendance is required and absentee must have a valid reason. Unless withdrawal is declared, the “Fail” grade will be given, when a student misses lectures more than three times. It will be also given, when he or she misses submission of reports more than three times.

●Notes

●Contacting Faculty

Email to terra@cc.nagoya-u.ac.jp

Graduation Research A (2.5credits) (卒業研究Ａ)

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

●Course Purpose

The purpose of this course is to develop creativity and acquire a research-oriented mindset through the study of specialized subjects in applied physics.

●Prerequisite Subjects

●Course Topics

Each student must perform theoretical, experimental, or computational research.

●Textbook

●Additional Reading

●Grade Assessment

Grades will be based on the a graduation thesis and presentation. Students must obtain a score of 60/100 or higher to pass.

●Notes

●Contacting Faculty

Graduation Research B (2.5credits) (卒業研究Ｂ)

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

●Course Purpose

The purpose of this course is to develop creativity and acquire a research-oriented mindset through the study of specialized subjects in applied physics.

●Prerequisite Subjects

●Course Topics

Each student must perform theoretical, experimental or computational research, write a graduation thesis and present it to faculty members.

●Textbook

●Additional Reading

●Grade Assessment

Grades will be based on the graduation thesis and presentation.Students must obtain a score of 60/100 or higher to pass.

●Notes

●Contacting Faculty

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

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

●Course Purpose

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

●Prerequisite Subjects

Nothing

●Course Topics

1. Introduction to Embedded Computing Systems and Related Technology　1.1 Fundamentals and Trends　1.2 Low Energy Design　1.3 Automotive Applications2. Introduction to Disaster Management and Related Technology　2.1 Introduction to Disaster Management　2.2 Disaster Management Technology　2.3 Disaster Management Related Mini class project3. Introduction to Mass Production and Related Technology　3.1 Introduction to Mass Production　3.2 Technology for Mass Production　3.3 Current Problems and Future of Mass Production

●Textbook

The lecture materials will be distributed in each lecture.

●Additional Reading

1.“Programming Embedded Systems”, Second Edition, Michael Barr and Anthony Massa, O`Reilly Media 20062.“Designing Embedded Processors: A Low Power Perspective”, Henkel, Jeorg and Parameswaran, Sri, Springer Published 2007.3.“Disaster Management in Japan”, Cabinet Office, Government of Japan (Available Online)
http://www.bousai.go.jp/panf/saigaipanf.pdfhttp://www.bousai.go.jp/1info/pdf/saigaipanf.pdf4.“Disasters by Design: A Reassessment of Natural Hazards in the United States (Natural Hazards and Disasters: Reducing Loss and Building Sustainability in a Hazardous World: A Series)”, Dennis Mileti, A Joseph Henry Press.5.“Toyota Production System: Beyond Large-Scale Production”, Taiichi Ohno, Productivity Press 1988

●Grade Assessment

Attendance: 40%, One report per lecture: 30%, Final presentation: 30%

●Notes

●Contacting Faculty

Lecturer: Gang ZengEmail: sogo@ertl.jpTel: 052-789-5420

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

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

●Course Purpose

This course discusses the fundamentals of, and current topics in each field of the advanced electrical, electronic and information engineering, with an overview of the status of their researches and developments in Japan. Topics to be introduced are those related with energy, material and device, information and communication, multimedia and so on. To familiarize students with the subject matter, trips to the related manufactuaring companies are planned

●Prerequisite Subjects

●Course Topics

1.Electrical Engineering 2.Electronic Engineering 3.Information and Communication Engineering

●Textbook

●Additional Reading

●Grade Assessment

reports

●Notes

●Contacting Faculty

Introduction to Civil Engineering and Architecture (2.0credits) (社会環境工学概論)

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

●Course Purpose

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

●Prerequisite Subjects

●Course Topics

Planned schedulesLecture & Site-visit 1: Architecture and culture – Nagoya Castle Hommaru Place Lecture & Site-visit 2: Architecture and culture – Nagakute Culture Center Lecture 1: Social infrastructure and civil engineering (1)Site-visit 3: Construction of new expressway (Central Nippon Expressway Co., Ltd)
Site-visit 4: Highway Traffic Control Center and Highway (Central Nippon Expressway Co., Ltd) Lecture and Site-visit 5: Nagoya University Disaster Mitigation & Management OfficeLecture 2: Social infrastructure and civil engineering (2)

●Textbook

●Additional Reading

●Grade Assessment

Students will be evaluated on attendance and written reports.

●Notes

●Contacting Faculty

Contact to Kentaro NAKAIEmail nakai@civil.nagoya-u.jp

Introduction to Chemical and Biological Industries (2.0credits) (化学・生物産業概論)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Fundamental and Applied Physics	Automotive Engineering	Automotive Engineering
Starts 1	4 Spring Semester	4 Spring Semester	4 Spring Semester
Elective/Compulsory	Elective	Elective	Elective
Lecturer	Associated Faculty		

●Course Purpose
The purpose of this course is to provide a broad overview of trends in chemical and biological industries in Japan.

●Prerequisite Subjects
Not specified.

●Course Topics
This course introduces cutting-edge R&D topics and anticipated future trends, and looks at chemical and biological production in Japan. It illustrates how these topics relate to society in general, how they play a role in energy and environmental issues, and how they affect the international community. The course will invite researchers with ample experience working abroad to give inspiring lectures in English.

●Textbook
Not specified.

●Additional Reading
N/A

●Grade Assessment
Grades will be based on written reports and effort/attitude in class. Students must obtain a score of 60/100 or higher to pass the course.Credits will be awarded to those students who score 60 or more.Grades are as follows: S:100 - 90, A:89 - 80, B:79 - 70, C:69 - 60, F:59 - 0.

●Notes

●Contacting Faculty
Students can ask questions during lecture hours.

Introduction to Applied Physics/ Materials and Energy Engineering (2.0credits) (物理・材料・エネルギー工学概論

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry Automotive Engineering	Fundamental and Applied Physics	Automotive Engineering
Starts 1	4 Spring Semester 4 Spring Semester	3 Spring Semester	4 Spring Semester
Elective/Compulsory	Elective Elective	Elective	Elective
Lecturer	Associated Faculty		

●Course Purpose

Fundamentals in applied physics, material science, and quantum energy are introduced. Magnetism and superconductivity, and recent topics of quantum computers are discussed. Materials sciences to resolve many problems in design of physical properties, in refining and formation processing of materials are discussed. Recent developments in materials science are introduced. Introduction to nuclear fusion and quantum energy utilization are also discussed.

●Prerequisite Subjects

●Course Topics

1. Introduction to magnetism 2. Introduction to quantum computers 3. Introduction to superconductivity 4. Introduction to laser materials processing I 5. Introduction to laser materials processing II 6. Introduction to nuclear fusion I 7. Introduction to nuclear fusion II 8. Introduction to nuclear fusion III 9. Introduction to nuclear fusion IV10. Fundamentals of ceramics and applications I11. Fundamentals of ceramics and applications II12. Fundamentals of ceramics and applications III13. Fundamentals of metals and applications I14. Fundamentals of metals and applications II

●Textbook

Lecture materials will be given during every lecture.

●Additional Reading

Shackelford, James F., Introduction to Materials Science for Engineers, Prentice Hall, Upper Saddle River, New Jersey, USA

●Grade Assessment

Evaluation will be based on written reports to be submitted at each lecture.

●Notes

●Contacting Faculty

Introduction to Production Engineering (2.0credits) (生産工学概論)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Fundamental and Applied Physics	Automotive Engineering
	Automotive Engineering		
Starts 1	4 Spring Semester	4 Spring Semester	3 Spring Semester
	3 Spring Semester		
Elective/Compulsory	Elective	Elective	Elective
	Elective		
Lecturer	Part-time Faculty		

●Course Purpose

Lecturers from Japanese leading industries provide the knowledge of the current status of production engineering in Japan. Developing the ability of understanding English lectures is expected.

●Prerequisite Subjects

none

●Course Topics

1. Production engineering in automobile industry 2. Production systems for automotive parts 3. Production engineering in aerospace industry 4. Production systems for aerospace products Foreign students have first priorities. The maximum number of students is limited to 30. In some lectures, group discussions and assignments may be done. Sufficient level of English language capability, TOEIC score of 600 or its equivalent as a minimum, is required.

●Textbook

Lecture notes are provided.

●Additional Reading

None

●Grade Assessment

Reports

●Notes

●Contacting Faculty