

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

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 1 b)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 \mathbb{R}^n , located vectors in \mathbb{R}^n , scalar product in \mathbb{R}^n , norm and scalar product in \mathbb{R}^n , 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 I a (1.0credits) (物理学基礎演習 1 a)

Course Type	Basic Specialized Courses		
Class Format	Exercise		
Course Name	Chemistry	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 Courses Calculus 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, 2010 ISBN:9780470576083)

Additional Reading

Grade Assessment

Grading Attendance 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 Kit Office: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jp
 KOUYAMA Tsutomu Office: Science Hall 7F 723 Phone: 052-789-5108 Email: kouyama@bio.phys.nagoya-u.ac.jp

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

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	Bernard GELLOZ Designated Professor	TAMA Florence Muriel Professor	

Course Purpose

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

Prerequisite Subjects

Related Courses Calculus I; Fundamentals of Physics I ; Fundamentals of Physics II

Course Topics

Course Contents See syllabus for Fundamental Physics II.

Textbook

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

Additional Reading

Grade Assessment

Grading Weekly 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 517 Phone: 052-789-2307 Email: john.wojdylo@s.phys.nagoya-u.ac.jp

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

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 2 b)

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	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 II a (1.0credits) (物理学基礎演習 2 a)

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	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 II b (1.0credits) (物理学基礎演習 2 b)

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	Compulsory	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. Oscillations 2. Introduction to Maxwell's Equations 3. Waves 4. Electromagnetic Waves 5. 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. Animals
1.1 Unifying concepts of animal structure and function
1.2 Nutrition and digestion
1.3 Gas exchange
1.4 Circulation
1.5 The immune system
1.6 Control of body temperature and water balance
1.7 Hormones and the endocrine system
1.8 Reproduction and embryonic development
1.9 Nervous system
1.10 The senses
1.11 How animals move
2. Plants
2.1 Plant structure, growth and reproduction
2.2 Plant nutrition and transport
2.3 Control systems in plants
3. Ecology
3.1 The biosphere: an introduction to Earth's diverse environments
3.2 Behavioral adaptations to the environment
3.3 Population ecology
3.4 Communities and ecosystems
3.5 Conservation biology

Textbook

The same textbook will be used as in Fundamentals of Biology 1: Campbell Biology: Concepts & Connections, 7th Ed. Jane B. Reece / Martha R. Taylor / Eric J. Simon / Jean L. Dickey Benjamin Cummings, 2011. Mastering 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 Maria
Office : School of Science, building E, room 202
Phone : 789-3530
E-mail : mnvassileva@bio.nagoya-u.ac.jp

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

Course Type	Basic Specialized Courses		
Class Format	Lecture and Exercise		
Course Name	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 (4.0credits) (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	SONNENSCHNEIN Volker Thomas Assistant 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, Elsevier, 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 Purpose This 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 & II Related Courses Physics Tutorial Ia, Mathematical Physics I & II, Analytical Mechanics II, Quantum Mechanics I & II

Course Topics

Course Contents 1. Newton's Laws of Motion 2. Momentum and Angular Momentum 3. Energy and Forces 4. Calculus of Variations 5. Lagrange's Equations 6. Hamiltonian Mechanics 7. 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 Library 1. 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

Grading Class 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	HOSSAIN Akter Designated Lecturer	

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.

Questions 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 1 a)

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

Theoretical formalism using Lagrangians and Hamiltonians is very useful for studying the motion of dynamical systems consisting of point particles and rigid bodies. In this lecture, students will gain an understanding of fundamental principles of theoretical formalism and learn technical aspects through simple applications.

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

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Phone: 052-789-3597

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

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

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.

Questions 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

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 Purpose This 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 517 Phone: 052-789-2307 Email: 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 Review 15 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: 789-2480 E-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 Purpose To 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 II Physics Tutorial IIb, Quantum Mechanics II

Course Topics

1. Mechanics in Non-Inertial Frames 2. Rotational Motion of Rigid Bodies 3. Introduction to Collision Theory 4. Special Relativity

Textbook

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

Additional Reading

These reference books are available in the Main Library 1. 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 Kit Office: ES420 Phone: 052-789-2861 Email: skfoong@eken.phys.nagoya-u.ac.jp
SUZUKI Takeru Ken Office: ES-611 e-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 Purpose After 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 Instructor Physics 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 517 Phone: 052-789-2307 Email: john.wojdylo@s.phys.nagoya-u.ac.jp

Applied Physics Tutorial II a (1.0credits) (応用物理学演習 2 a)

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 Makio UWAHA Professor Professor

Course Purpose

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

Applied Physics Tutorial II b (1.0credits) (応用物理学演習 2 b)

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 Makio UWAHA Professor Professor

Course Purpose

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

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

Course Type	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 Elective	Compulsory	Compulsory
Lecturer	EijiroTAKEUCHI Associate Professor	Hiraku okada 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 interface
2. 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).

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	Part-time Faculty		

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.

Applied Physics Tutorial III a (1.0credits) (应用物理学演習 3 a)

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

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

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

Course Type	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

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. 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. Mechanics of elastic bodies
2. Fluid Mechanics.

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

Applied Physics Tutorial III b (1.0credits) (应用物理学演習 3 b)

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

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

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 Contents

1. Brief history of biophysics
2. Biomolecules – amino acids and proteins
3. Biomolecules – nucleic acids
4. Biomolecules – lipids and membranes
5. Central dogma of molecular biology
6. Protein folding and salvation effects
7. Asakura-Oosawa theory of depletion forces
8. Protein unfolding (denaturation) at high temperature and by denaturants
9. Cold denaturation of proteins
10. Protein unfolding at high pressure
11. Computer simulations of protein folding and unfolding

Textbook

Additional Reading

Grade Assessment

Grading Evaluation will be based on attendance and reports (take-home exams). Criteria for “Absent” & “Fail” Grades Class 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: 052-789-3528 Email: 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	Tsutomu TAKEUCHI Associate Professor

Course Purpose

Course Purpose To 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 Contents 1. Hierarchy of the universe 2. Basic Astrophysical Concepts 3. Our Solar System: Sun and Planets 4. Stars and Interstellar Medium 5. The Milky Way Galaxy 6. Galaxies in the Universe 7. The evolution of galaxies 8. Cluster of galaxies and the large-scale structure 9. Cosmic microwave background radiation and Big Bang 10. Big Bang Nucleosynthesis and beyond 11. Cosmic inflation 12. The history of the Universe

Textbook

Material will be distributed during the courses.

Additional Reading

An Introduction to Modern Astrophysics, Second Edition (Bradley W. Carroll & 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 Tsutomu E-mail: takeuchi.tsutomu@g.mbox.nagoya-u.ac.jp INUTSUKA Shu-ichiro E-mail: inutsuka@nagoya-u.jp

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	HOSSAIN Akter Designated Lecturer

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 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.

Questions 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 II Physics Tutorial III, Analytical Mechanics I & II, and Electricity & Magnetism

Course Topics

Course Contents 1. Operator methods in quantum mechanics 2. Angular momentum 3. Spin 4. Time-independent perturbation theory 5. The real hydrogen atom - fine structure and anomalous Zeeman effect 6. Identical particles and Pauli exclusion principle 7. Ground state and excited states of Helium atom 8. 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" Grades 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

Applied Physics Laboratory II (1.5credits) (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 strengthened 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 knowledge of electromagnetic waves in matters and polarization of light.
2. The ability to explain the interaction between light and matters using a classical model of atoms.
3. The ability to explain the light emission and the principle of lasers.

Prerequisite Subjects

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 determined 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 crystal structures of solids and their determination by diffraction techniques. First the different types of atomic bonding are introduced. Then some mechanical properties are discussed, then crystal structures are presented based on a symmetry analysis. The reciprocal lattice is described in relation to the diffraction phenomenon. The relations of the reciprocal lattice with Fourier analysis and plane waves are discussed. Some practical aspects of X-ray diffraction are presented for the cubic crystal system. The amplitude and intensities of diffraction peaks are discussed, introducing structure and form factors.

Prerequisite Subjects

Course Topics

1. Bonding in Solids
2. Crystal Structure and Periodic Structure
3. Bravais Lattices; Famous Crystal Structures
4. Typical Symmetry Elements
5. Real Space and Reciprocal Space
6. X-ray diffraction; Bragg Condition; Laue Function
7. Brillouin zone
8. Crystal Structure Factor
9. Structure Determination by X-ray diffraction
10. Elastic properties of solids and elastic strains

Textbook

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

Additional Reading

Ashcroft & Mermin: Solid State Physics (Brooks/Cole) Price: ~\$60
P. 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

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 Purpose To 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 Contents 1. Review of basic thermodynamics 2. Thermodynamics of multi-component systems 3. Chemical equilibrium 4. Phase equilibrium 5. Chemical kinetics 6. 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	DaisukeYOKOGAWA Designated Associate Professor	

Course Purpose

Computers are becoming one of the useful tools to proceed researches in chemistry. By using computers, scientists can study any kinds of materials, such as highly toxic molecules, unstable compounds, and so on. However, to get results from computers, we have to prepare programs that contain commands. In this class, we study how to prepare such a program.

Prerequisite Subjects

Course Topics

1. Calculation of the area of a circle
 - (i) Introduction to Fortran program
 - (ii) data types and variables
 - (iii) do loops
 - (iv) If and else if
 - (v) subroutine and function
2. Challenging study to make a maze solving program
 - (i) How to simplify the problem
 - (ii) Presentation

Textbook

Additional Reading

Larry Nyhoff, Stanford Leestma: Introduction to FORTRAN90

Grade Assessment

Evaluation of attendance and report assignment

Notes

Contacting Faculty

email:d.yokogawa@chem.nagoya-u.ac.jp

room:ITbM505

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 Associate Professor	

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	HOSSAIN Akter Designated Lecturer

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.

Questions 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 Purpose Students 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 Instructor Physics 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” Grades
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 517 Phone: 052-789-2307 Email: john.wojdylo@s.phys.nagoya-u.ac.jp

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

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 4 b)

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

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 (1.5credits) (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 Purpose Building 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” Grades 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 517 Phone: 052-789-2307 Email: 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; Phonons
2. Heat capacity of solids - Classical theory
3. Heat capacity of solids - Einstein model and Debye model
4. Thermal conductivity of solids
5. Introduction to electron theory of metals; Drude model
6. Free electron model: quantum approach; Fermi sphere
7. Concept of energy bands
8. Fermi-Dirac distribution function
9. Electronic specific heat
10. Semiconductors
11. Dielectric properties of solids

Textbook

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

Additional Reading

Ashcroft&Mermin: Solid State Physics (Brooks/Cole) Price: ~\$60
P. 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 a (1.0credits) (应用物理学演習 5 a)

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

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

Applied Physics Tutorial V b (1.0credits) (应用物理学演習 5 b)

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

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

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. UWABA, 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 Thermoelectricity 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

Particle Physics (2.0credits) (素粒子物理学)

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

Course Purpose

Prerequisite Subjects

Course Topics

Textbook

Additional Reading

Grade Assessment

Notes

Contacting Faculty

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

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	Elective
Lecturer	Marc HUMBLET A. Designated Associate Professor	

Course Purpose

Never before have humans had such a profound impact on the Earth. The world population exceeds 7 billion and is growing steadily. Industrial and technological needs for energy and mineral resources are increasing every year. In this course, we will see how humanity is changing the environment. In particular we will explore climate change in the geological past and the relationships between human activities and climate today. The students will also learn about the nature and usefulness of geological resources and the environmental threats posed by petroleum and mineral industries. Finally, we will reflect on the opportunities and challenges for a sustainable use of geological resources.

Prerequisite Subjects

Fundamentals of Earth Science I & II

Course Topics

1. Global biogeochemical cycles
2. Paleoclimatology
3. Recent global warming I: Mechanisms
4. Recent global warming II: Prevention, mitigation and adaptation
5. Geological resources I: energy from the Earth
6. Geological resources II: useful rocks and minerals
7. Growth with limited resources: problems and solutions

Textbook

None

Additional Reading

None

Grade Assessment

Students will be graded following the five-step S-A-B-C-F grade evaluation system. S: 90-100%, A: 80-89%, B: 70-79%, C: 60-69%, F: 59-0%
Two quizzes: 30% (15% each)
Oral presentation: 30%
Written essays: 40%
A student who wishes to withdraw from the course must submit a withdrawal request form to the instructor by the end of May in order to receive an "Absent" grade. A student will be given an "Absent" grade if he or she submits a Course Withdrawal Request by the end of May. This deadline does not apply to students who drop the class part-way through for an exceptional reason (e.g. illness, accident). A "Fail" grade is given to students who obtain a final score of less than 60%.

Notes

Contacting Faculty

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

Graduation Research A (5.0credits) (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 (5.0credits) (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	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 Applications
2. 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 project
3. 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 2006.
2. "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.pdf>
<http://www.bousai.go.jp/1info/pdf/saigaipanf.pdf>
4. "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 Zeng
Email: sogo@ertl.jp
Tel: 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	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 manufacturing 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

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 schedules
Lecture & 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 Office
Lecture 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 NAKAI
Email 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 Physical Science and Engineering (2.0credits) (物理工学概論)

Course Type	Related Specialized Courses		
Class Format	Lecture		
Course Name	Chemistry	Fundamental and Applied Physics	Automotive Engineering
Starts 1	Automotive Engineering 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 IV 10. Fundamentals of ceramics and applications I 11. Fundamentals of ceramics and applications II 12. Fundamentals of ceramics and applications III 13. Fundamentals of metals and applications I 14. 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