ナノ・分子物性概論 Introduction to Nanoscience
[Instructor] supervising teacher
[Credits] 2
[Semester] 1st year-Spring-Fri 5
[Course code] T1S001001
[Room] Bldg.Eng.2-101 (Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Teaching description] An introductory education will be given to the students in the first grade of Department of Nanoscience.
[Course objectives] Students will learn the outline of the education and research performed in Department of Nanoscience.
[Plans and Contents] Students will observe the omnibus seminars regarding the education and research of the guidance faculty
[Textbooks and Reference Books] None in Particular
[Evaluation] Attendance, report writing

プロジェクト研究 II Project　Research　II
[Instructor] Kazunuki Yamoto, Koji Okudaira
[Credits] 2
[Semester] 2nd year-Spring-Fall Fri. 2
[Course code] T1S003001
[Room] ※Bldg.Eng.4-109　Laboratory
[Teaching description] Students will perform experiments of physics and chemistry continuously from the project research 1.They will either individually or in a group perform a case research to learn the basic flow of the research. They will further learn a series of a research activity flow, including how to make a research theme, make a research plan, perform an experiment, rectify, analyze and examine the data.
[Course objectives] They will master how to use experimental devices and mechanical tooling device's at a relatively higher level.-They themselves will think themes on the experiments, plan and perform the experiments, and present the results
[Plans and Contents] Guidance; Students will master: tooling technology (turning machine, ball machine, and milling machine); the experimental basic technology of physics and chemistry; data rectification with computers; electronic tooling electronic tooling; combination of conductive polymers in chemical experiment, and vibration reaction; suggestion of a voluntary theme from the students for free research (prior meeting, intermediate reporting session, final reporting session, and the report preparation)
[Textbooks and Reference Books] None in particular
[Evaluation] Attendance・Reports・Presentation
[Course requirements] Basically target for Risu-oen Project.

物理数学 I　Mathematics for Physics I
[Instructor]（Tsuyoshi Ueta）
[Credits] 2
[Semester] 2nd year-Spring-Mon 5
[Course code] T1S004001
[Room] Bldg.Eng-17-113
[Course enrollment] Seating capacity of the classroom
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Through two lectures, mathematics for physics I and II, mathematical fundamentals required in order to understand the special fundamentals and special subjects learning after the sophomore and to solve problems on physics and engineering are covered. Mathematics for physics I gives mathematics regarding vector analysis and matrices required for physics.
[Course objectives] Students will understand the properties of vectors and matrices which appear in dynamics, electromagnetism, quantum mechanics and solid state physics. They also learn concrete computational methods needed in order to solve physical problems, such as linear transformation and eigenvalue problems.
[Plans and Contents] Basically, exercises will be planned every two lectures. However, the pace and the contents of the lecture will be changed in consideration of students' comprehension. Many problems are prepared for exercises, so that students who do not solve all the problems in class should solve the remaining problems by themselves. Students should also prepare for the next lecture with the references mentioned below. After every class, they should solve example and exercise problems in the references by themselves.
1.Guidance, Interval of Physical Problem and Mathematical Problem (Scaling Law)
2.Vector-Analysis Summary (differentiation, integration), Matrices Algebra (Vectors, Matrices, Determinant)
3.Vector and Transformation (Vector Space, Linear Transformation, Simultaneous Linear Equations)
4.Exercise
5.Diagonalization of matrices (Eigenvalue Problems, Similarity Transformation, Normal Matrix, Hermitian Form, Problem on the Maximum Value of the Minimum　Eigenvalue)
6.Examples of Matrices in Physics (Small Vibration around Stable Equilibrium Positions, Rotation and Angular Momentum, Etc.)
7.Exercise
8.Functions of Matrices (Polynomial, Power Series, Functions of Diagonalizable Matrices)
9.Functions of Matrices (Inverse Matrix, Exponetial and Logarithmic Functions)
10.Exercise
11.Matrices of Infinite Rank (Hilbert Space, Representations of Operators)
12.Matrices of Infinite Rank (Transformation of Representations, Eigenvalue Problems, and Continuous Eigenvalues)
13.Analytical Mechanics and Quantum Mechanics
14.Functions of a Complex Variable (Complex variables, Functions of a Complex Variable and Differentiation, Elementary Functions)
15.Exercise
16.The end term Exam
[Keywords] Vector Analysis, Matrices, Vector Spaces, Diagonalization of Matrices, Hermitian Form, Functions of a Matrix, Quantum Mechanics
[Textbooks and Reference Books] Linear Algebra (Masterpieces of Mathematics learning from the beginning; Macquarie 2); written by Donald Macquarie, translated by Miyoko Irie, published by Kodansha. will be designated as the textbook, while it does not contain the entire lecture.
This is one of the series textbook translated from D. A. McQuarrie : Mathematical Methods for scientists and engineers. Students are strongly recommended to buy the original version.
Students in the department of engineering will no more books necessary for the mathematics except it.
Answers of the problemss in this book are published in　C. H. Mcquarrie:Solutions To Accompany Mcquarrie's Mathematical Methods For Scientists And Engineers (Univ Science Books).
Introduction of Analysis, written by Kentaro Yano and Shigeru Ishihara published by Shoukabou will be used as the textbook for the Mathematics for physics II,
It contains the description on the vector analyses dealt in the mathematics for physics I, so that students planning to take the Mathematics for physics II are recommended to buy this book in advance.
If the students desire to learn it at higher level, P. R. Wallace: Dover Mathematical Analysis of Physical Problems is recommended.
[Evaluation]

No mid-term test will be conducted since a seminar is included. Evaluation of results will be based on the score of the final exam only.

[Related courses]

Linear Algebra B1 & B2, Differential Equation, Calculus B1 & B2, Mathematics for Physics II, all physics subjects

[Course requirements]

Credits for Linear Algebra B1 & B2, Calculus B1 & B2 to be obtained. Even students without the credits of these subjects are permitted to enroll this class, whereas lecture will be conducted assuming knowledge of these subjects.

物理数学 IIMathematics for Physics II
[Instructor]Tsuyoshi Ueta
[Credits] 2
[Semester] 2nd year-Fall Fri 2
[Course code] T1S005001
[Room] Bldg.Eng17-212
[Course enrollment] Seating capacity of the classroom
[Candidate] S Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course description] Through two lectures, mathematics for physics I and II, mathematical fundamentals required in order to understand the special fundamentals and special subjects learning after the sophomore and to solve problems on physics and engineering are covered.
Mathematics for physics II gives mathematics regarding functions of complex variables, differential equations, Fourier series expansions, and Fourier transforms necessary for the physics.
[Course objectives] Students will understand the properties of complex functions, ordinary and partial differential equations which appear in dynamics, electromagnetism, quantum mechanics and solid state physics. They also learn concrete computational methods needed in order to solve physical problems, such as time evolution problems and eigenvalue problems.
[Plans and Contents] The pace and the contents of the lecture will be changed in consideration of students' comprehension. Many problems are prepared for exercises, so that students who do not solve all the problems in class should solve the remaining problems by themselves. Students should also prepare for the next lecture with the references mentioned below. After every class, they should solve example and exercise problems in the references by themselves.

1. Guidance, Complex functions (elementary functions)
2. Functions of a complex variable (contour integral, regular function)
3. Functions of a complex variable (the residue theorem and its applications, method of steepest descent)
4. Exercise
5. Solutions of Ordinary Differential Equation (the Variation of Constants Method, the Power Series Method, Linear Differential Equation)
6. Linear Ordinary Differential Equation with Constant Coefficients (Homogeneous Equation, Particular Solution, the Iterative Method, Adjoint Differential Operators)
7. Exercise
8. Boundary Value Problems of Linear Second order Differential Equations (Sturm-Liouville theory, Green Function)
9. Properties of Eigenfunctions (Orthogonality, Completeness)
10. Laplace Transform (Laplace Transform, Inverse Transformation, and Various Properties, Convolution Integrals)
11. Exercise
12. Partial Differential Equation (1st Order Partial Differential Equation, General Solutions of the 2nd Order Partial Differential Equation with Constant Coefficients)
13. Initial and Boundary Value Problems of the Second order Linear Partial Differential Equations (Separation-of-Variables Method, Eigenfunction Expansion Method)
14. Fourier series and Fourier Transform
15. Exercise
16. The End term Exam

[Keywords] complex functions, the residue theorem, power series expansion, the Fourier transform, ordinary differential equations, partial differential equations
[Textbooks and Reference Books] Since this lecture covers very wide various contents, it is difficult to choose a textbook as one volume, whereas Kaisekigaku Gairon Shinban by Kentaro Yano and Shigeru Ishihara (Shokabo) shall be used as a textbook.
The publication by D. A. McQuarrie: Mathematical Methods for Scientists and Engineers (University Science Books) (a translated version in separate volumes is available from Kodansha) is also strongly recommended as a textbook.
For students of the Faculty of Engineering, other books on mathematics are probably not necessary if they have this book.
The answer of the problem of this book is published in Mcquarrie: Solutions To Accompany Mcquarrie’s Mathematical Methods for Scientists and Engineers (Univ Science Books).
For those who want to learn more, P. R. Wallace: Mathematical Analysis of Physical Problems (Dover) is recommended.
[Evaluation] No mid-term test will be conducted since the plan is to conduct mini-tests due to the huge volume of contents involved. Evaluation shall be based on the score of the final exam only.
[Related courses] Linear Algebra B1 & B2, Calculus B1 & B2, Mathematics for Physics I.
[Course requirements] Students should be taking Mathematics for Physics I.

振動と波動 Oscillations　and Waves
[Instructor] Kazunuki Yamamoto
[Credits] 2
[Semester] 2nd year-Spring Wed 4
[Course code] T1S006001
[Room] Bldg.Eng5-104
[Candidate] Other Department's students
[Teaching description] Students will be lectured about basic property between the vibration and the wave motion, specifically phenomena including a single vibration, attenuation vibration, forced vibration, resonance, wave motion equation, wave propagation, interference, and diffraction.
[Course objectives] Students will learn the physical meaning of the wave motion through induction of the wave motion equation, and learn the phenomena unique to the wave motion, including the interference and the diffraction. They will also learn mathematical coverage of the wave motion as an introduction to the quantum dynamics.
[Plans and Contents]
1. Simple harmonic vibration and its composition
2. Damped vibration
3. Forced vibration and resonance
4. Coupled vibration
5. String vibration
6. Longitudinal wave propagation along a rod
7. Wave equation and its solution
8. Planar wave and spherical wave
9. Optical wave
10. Geometrical optics
11. Geometrical optics
12. Optical interference (coherence and incoherence)
13. Slit diffraction
14. Diffraction grating
15. Polarized light
16. The End term Exam

[Keywords] simple harmonic oscillation, damped oscillation, forced oscillation, resonance, wave equation, interference, diffraction
[Textbooks and Reference Books] "Wave, Optics, Thermology" Syouichiro KOIDE, Syoukabou, ISBN4-7853-2076-1
[Evaluation] Attendance，Reports、The End term Exam

電磁気学　Electromagnetic Theory
[Instructor] KRUEGER PETER
[Credits] 2
[Semester] 2nd year-Fall Tues 2
[Course code] T1S007001
[Room] Bldg.Eng.17-211
[Course enrollment] Seating capacity of the classroom
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course objectives] The objective is that the students acquire a basic understanding of the elementary time-dependent electro-magnetic phenomena as well as the macroscopic theory of electromagnetism in matter.
[Teaching description] First electromagnetic induction and simple circuits with complex impedance are studied. Then Maxwell equations are learned and energy propagation and electromagnetic waves in vacuum are discussed. In the last third of the lecture, the basic phenomenological theory of electromagnetism in matter is outlined.
[Plans and Contents]

1. Experimental results of electromagnetic induction
2. Faraday's Law of Electromagnetic Induction Self-inductance
3. Mutual inductance, static magnetic field energy
4. Alternative current circuits, complex impedance
5. Exercises
6. Charge conservation law, displacement current.
7. Maxwell's equations
8. Electromagnetic field energy
9. Mid-term Exam
10. Electromagnetic waves
11. Electromagnetic radiation and polarization
12. Electric field in matter, P and D fields
13. Boundary conditions in dielectrics
14. Magnetic field in matter, magnetic materials
15. Oscillating field in dielectrics
16. Exam

[Keywords] Electromagnetic induction, Maxwell equations, electromagnetic waves, dielectrics, magnetic materials.
[Textbooks and Reference Books] Textbook:. Reference book: D. J. Griffith, Introduction to Electrodynamics (Prentice Hall).
[Evaluation]　Attendance and homework reports (30%), mid-term exam (30%), final exam (40%)
[Course requirements]
Taking Physics CI Introduction to Electromagnetism 1 and Physics CII Introduction to Electromagnetism 2.

構造解析学 Structural Analysis
[Instructor] Yoshihiro Okamoto
[Credits] 2
[Semester] 2nd year-Fall Wed 5
[Course code] T1S008001
[Room] Bldg.Eng5-104
[Course enrollment] 40
[Teaching description] Students will understand physical structure of various materials and learn some methods for investigating the structure. The crystal structure and the X-ray diffraction method will be mainly introduced in the lecture. In addition to them, latest topics in the field of structural analysis reported in the SPring-8 and the J-PARC will be mentioned.
[Course objectives] It is a purpose that the class will be useful for the research in future with the following three goals. (1) To understand structures of various materials with crystal as a base, using actual examples (2) to understand the principles for some of the typical structural analyses centralizing a diffraction method (3) to train ability to select an appropriate structural analysis method for the various materials and purposes
[Plans and Contents] Basics of the crystal structure; reciprocal space; the principle of XRD; and other structure analyses methods

1. Introduction: What is structural analysis?
2. Basics of crystalline structure 1: Bravais lattice and crystal system
3. Basics of crystalline structure 2: Space group symbols and mirror index
4. Basics of crystalline structure 3: Description of crystalline structure
5. Basics of X-ray: Source, characteristic X-ray, synchrotron radiation
6. X-ray diffraction 1: Bragg conditions
7. X-ray diffraction 2: Concept of reciprocal lattice
8. X-ray diffraction 3: Analysis example
9. Neutron diffraction: Principle, differences from X-ray diffraction
10. Single crystal and polycrystalline
11. X-ray absorption fine structure and small angle X-ray scattering
12. Structural analysis of structurally disordered materials
13. Structural analysis using a personal computer
14. Various structural analysis methods: NMR, Raman spectroscopy etc.
15. Structural analysis research topics and summary
16. The End term Exam

[Keywords] Crystal structure, Reciprocal space, X-ray diffraction, Electron beam diffraction
[Textbooks and Reference Books] Lecture is conducted using distributed materials. Reference books etc. shall be indicated during the lectures.
[Evaluation] Evaluation to be based on Attendance, Reports writing and The end term Exam

回路理論 Electric Circuit Theory
[Instructor] Atsuo Sadakata
[Credits] 2
[Semester] 2nd year-Fall Wed 4
[Course code] T1S013002
[Room] Bldg. Eng-17-211
[Course enrollment] Seating capacity of the classroom
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Students will be lectured about the basics of the electric circuit which should be mastered in performing a student experiment and a graduate research. The students will start reviewing the DC circuit, introducing basic theorems, and then introducing a concept of impedance which will be expanded to the AC circuit, so that they will be able to solve the basic questions in a static-state.
[Course objectives] Students will master the basis of the practical method of use, including basic concept of the electric circuit, an expression method, an analysis method and a meaning of physical phenomena necessary for performing a student experiment and a graduate research. In every lecture, they will solve exercise questions, so that they will more understand the basics, and it is a goal that they will be able to solve questions on DC and AC circuits themselves finally.
[Plans and Contents] Students will learn basic knowledge including physical meanings of voltage, current and power in the DC circuit; serial and parallel connections; Ohm's law; Kirchhoff's laws. Then, they will understand voltage in the AC circuit; definition of current; roles of the impedance and the capacitance; and a concept of the impedance and the adminitance to learn about complex number expressions. They will furthermore learn mesh analysis, nodal analysis, and general theorems of the electric circuit, so that they will master an analysis method of a linear circuit. Since the students will more understand the electric circuit when they solve questions, they will be provided with homework at the end of the class every time, and they will have to submit the homework at the beginning of the lecture next week.

1. Review on DC circuit- Students will learn the definition of power, voltage, and current, and review Ohm's law; meanings of serial and parallel connections; combination of a resistance and power source.
2. Basics of electric circuit - Students will adopt basic laws such as Kirchhoff's laws in the circuit networks, power, and Joule heat to the DC circuit to master a calculation method for electric quantities.
3. Circuit analysis- Students will learn how to prepare a circuit network equation such as a mesh equation; and a nodal equation, and the solution method.
4. Basic theorems in the electrical circuits - Students will learn basic theorems including Superposition principle, Thevenin's theorem and Norton's theorem, and Millman's theorem. Summary and exercises on DC circuit
5. Basics of the AC circuit 1 - Students will review basic trigonometric function, and learn vector notation and complex notation necessary for the AC circuit analysis.
6. Basics of the AC circuit 2 - Students will review basic trigonometric function, and learn vector notation and complex notation necessary for the AC circuit analysis.
7. Property of R, L, C and AC voltage - Students will learn induction of the average value, the effective value, the moment power, and the average power.
8. Summary of the AC circuit regarding the first part and review
9. R-L, R-C serial and parallel circuits 1 - Students will learn vector notation of the impedance and power.
10. R-L-C Resonance circuit and bridge circuit - Students will understand resonance phenomena, and learn solution methods for the resonance circuit and the bridge circuit.
11. Response vector locus in AC circuit - Students will understand a change of impedance along a change in frequency, and learn a solution method of the vector trace.
12. Coupled circuit - Students will learn a solution method of a circuit including a coupled circuit such as transmitter.
13. Review and exercises so far
14. Exercises
15. Final exam

[Keywords] DC circuit, AC circuit, Kirchhoff's laws, Superposition principle, Thevenin's theorem, Norton's theorem, and Millman's theorem, impedance, vector notation, complex notation, coupled circuit
[Textbooks and Reference Books] Textbooks: “Nyumon Denkikairo” Michio Iemura, Ohm-sha, ISBN 4-274-20041-8
Reference Books: “Denkikairokyohon”, Ohm-sha, ISBN 4-274-13226-9
[Evaluation] Overall evaluation to be based on attendance, homework, seminar and final exam.

量子力学 I Quantum Mechanics I
[Instructor]Kazuyuki Sakamoto
[Credits] 2
[Semester] 3rd year-Spring Fri 4
[Course code] T1S014001
[Room] Bldg Eng2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 50
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Students will be lectured about, for example, behavior of the electrons in solid regarding the basic knowledge on the quantum dynamics which is indispensable to learn and research material science including Nano Science.
[Course objectives] They will understand the basics of the quantum physical phenomena expanded in the solid, and master the basic knowledge in learning material science.
[Plans and Contents]

1. Introduction and revision of basic quantum mechanics
2. Free particles
3. Uncertainty principle
4. Physical quantity and expectation value
5. Schroedinger equation
6. Infinite potential well
7. Finite potential well
8. Various potentials
9. Expression of quantum mechanics state I
10. Expression of quantum mechanics state II
11. Orbital angular momentum I
12. Orbital angular momentum II
13. Spin angular momentum
14. Electron motion in a periodic potential field I
15. Electron motion in a periodic potential field II

[Textbooks and Reference Books] To be introduced during the first lecture.
[Evaluation] Overall evaluation to be based on attendance, several mini-tests to be conducted during lessons and the results of the final exam.
[Course requirements] Taking of Physics EI Introduction to Quantum Mechanics is recommended.

量子力学演習 I　 Exercises in Quantum Mechanics　I
[Instructor] Kazuyuki Sakamoto
[Credits] 2
[Semester] 3rd year-Spring Fri 5
[Course code] T1S015001
[Room] Bldg.Eng2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 50
[Candidate] Students in other departments in the own faculty, in other departments, and Specially Registered Non-Degree Student may take this course
[Teaching description] They will perform exercises related to the quantum physical phenomena expanded in the solid while they are kept in close relation with the quantum dynamics.
[Course objectives] Students will train basic knowledge for understanding the quantum dynamic phenomena occurring in the solid.
[Plans and Contents] Question exercises will be provided to students who take a course of the quantum dynamics in order to more understand the description of the lecture

1. Introduction and revision of basic quantum mechanics
2. Free particles
3. Uncertainty principle
4. Physical quantity and expectation value
5. Schroedinger equation
6. Infinite potential well
7. Finite potential well
8. Various potentials
9. Expression of quantum mechanics state I
10. Expression of quantum mechanics state II
11. Orbital angular momentum I
12. Orbital angular momentum II
13. Spin angular momentum
14. Electron motion in a periodic potential field I
15. Electron motion in a periodic potential field II

[Evaluation] Overall evaluation to be based attendance and reports.
[Related courses] Quantum Mechanics I

量子力学 II Quantum Mechanics II
[Instructor] (Atsushi Nakamura)
[Credits] 2
[Semester] 3rd year-Fall Tues 1
[Course code] T1S016001
[Room] Bldg.Eng2-102 (Bldg. GEN- F51)
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 50
[Teaching description] Lecture students will be lectured about those which are not specifically covered in the lecture "Quantum Mechanics I" including analytical mechanics which connects the quantum mechanics with the classical mechanics, and the matrix mechanics which is at another aspect of the quantum mechanics as wave mechanics. They will be also lectured about perturbation theory, which is important in application of the quantum mechanics. The lecture will be provided with example questions as many as possible, reminding of the application.
[Course objectives] Students will master mathematical basics, and ability to understand the quantum phenomena of the solid physics in learning the quantum mechanics.
[Plans and Contents]

1. Analytical Mechanics (1) Equations of motion and Lagrangian
2. Analytical Mechanics (2) Least action principle and Lagrangian
3. Analytical Mechanics (3) Hamiltonian and canonical equations
4. Analytical Mechanics (4) Hamiltonian and Poisson brackets
5. Matrix Mechanics (1) Physical quantities and operators, expectation values
6. Matrix Mechanics (2) Hermite matrix and unitary matrix
7. Matrix Mechanics (3) Matrix representation of operators
8. Matrix Mechanics (4) Commutation relation of operators
9. Matrix Mechanics (5) Time evolution operator and preparation for applications
10. Matrix Mechanics (6) Applications – Harmonic oscillator
11. Perturbation Theory (1) Stationary state I (with no degeneracy)
12. Perturbation Theory (2) Stationary state I (continuation of no degeneracy)
13. Perturbation Theory (3) Stationary state II (with degeneracy)
14. Perturbation Theory (4) Stationary state II (continuation of degeneracy)
15. Perturbation Theory (5) Time-dependent cases

[Textbooks and Reference Books] The notification will be taken in First Lecture
[Evaluation] Homework for each lesson, with several seminars to be conducted during the lectures. The results of these shall form 40% of the overall evaluation with the remaining 60% to be based on results of the final exam on the 16th lesson.
[Course requirements]
Physics EI Introduction to Quantum Mechanics, Quantum Mechanics I, Seminar on Quantum Mechanics I, Seminar on Quantum Mechanics II are recommended to be taken.

量子力学演習 Seminar II Seminar on Quantum Mechanics II
[Instructor] Toru Shinohara
[Credits] 2
[Semester] 3rd year-Fall Tues 2
[Course code] T1S017001
[Room] Bldg.Eng2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 50
[Teaching description] Typical questions of the analysis mechanics, matrix mechanics, and perturbation theory will be taken up and perform exercises on an assumption of the description learned at the lecture “Quantum Mechanics II”.
[Course objectives] It is a goal that students will learn solution methods for the typical questions regarding the quantum mechanics, so that they will more understand physical phenomena caused by the quantum mechanics.
[Plans and Contents]

1. Guidance
2. Analytical mechanics (1) Equations of motion and Lagrangian
3. Analytical mechanics (2) Principle of least action and Lagrangian
4. Analytical mechanics (3) Hamiltonian and canonic equation
5. Analytical mechanics (4) Hamiltonian and Poisson brackets
6. Matrix mechanics (1) Physical quantity & operator, expectation
7. Matrix mechanics (2) Hermitian matrix and unitary matrix
8. Matrix mechanics (3) Matrix representation of operator
9. Matrix mechanics (4) Commutation relation of operator
10. Matrix mechanics (5) Time decay operator and preparation for use
11. Matrix mechanics (6) Applications – Harmonic oscillator
12. Perturbation theory (1) Steady state I (with no degeneration)
13. Perturbation theory (2) Steady state I (continuation of no degeneration)
14. Perturbation theory (3) Steady state II (with degeneration)
15. Perturbation theory (4) Steady state II (continuation of degeneration)
16. Perturbation theory (5) Time-dependent cases

[Textbooks and Reference Books] Will be distributed issue of practice.
[Evaluation] Basically, attendance to the class is a must. Students will make a presentation, using a blackboard, of the answers and explanation regarding the practice exercises which will be distributed in advance and a degree of the understanding will be collectively evaluated through questions and answers. (more or less 1 to 3questions per student in 15 exercises) A report assignment will be also given as needed.

物性物理科学 I Introduction to Solid State Physics I
[Instructor] KRUEGER PETER
[Credits] 2
[Semester] 3rd year-Spring Fri 3
[Course code] T1S018001
[Room] Bldg.Eng2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Course enrollment] 40
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course objectives] This lecture introduces basic concepts needed for the understanding of physical properties of crystalline solids. The underlying microscopic phenomena such as lattice vibrations and electronic states are presented and the link with measurement and thermodynamic properties is made.
[Plans and Contents] The lecture closely follows the first half of the textbook "C. Kittel – Introduction to solid physics (part 1)". The students will learn basic concepts of crystallography, x-ray diffraction, crystal bonding, lattice vibrations and the free electron gas.

1. The crystal lattice
2. Crystallographic planes (Miller indices), simple crystal structures.
3. Wave diffraction and reciprocal lattice
4. Amplitude of scattered wave: use of Fourier analysis,
5. Brillouin zone, structure factor
6. Exercises
7. Mid-term-exam
8. Crystal binding: rare gas crystals, ionic crystals
9. Crystal binding: covalent, metallic and hydrogen bonding
10. Crystal vibrations, phonon bands
11. Thermal properties. Einstein and Debye model
12. Non-harmonic interaction, thermal conductivity
13. Exercises
14. Free electron Fermi gas: energy levels, density of states.
15. Free electron Fermi gas: specific heat and conductivity
16. Test

[Keywords] Crystal structure, x-ray diffraction, reciprocal lattice, energy bands, Fermi-Dirac distribution, density of states.
[Textbooks and Reference Books] Kittel's Introduction to Solid State Physics (1st Vol) 8th Edition is used as a textbook. A useful reference book is N. W. Ashcroft, N. D. Mermin, Solid State Physics, Cengage Learning (1976).
[Evaluation] Evaluation to be based on homework reports (30%), mid-term exam (30%) and final exam (40%).
[Related courses] Introduction to Quantum Mechanics, Seminar on Quantum Mechanics, Quantum Molecular Science, Physical Science I, II, III,

物性物理科学 II　Introduction to Solid State Physics II
[Instructor] AOKI, Nobuyuki
[Credits] 2.
[Semester] 3rd year-Fall Fri 3
[Course code]T1S019001
[Room] Bldg.Eng17- 212
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] This class lectures solid state physics especially phenomena and principal of carrier conduction along textbook of “Charls Kittel, Solid State Physics”.
[Course objectives] Students will comprehend basis on band theory which is important for understand electric transport in solid state.
[Plans and Contents]
This class lectures along the contents from section 6 to 10 in the textbook. Starting from free electron model, band gap and the formation will be lectured. Band structure and Fermi surface in semiconductor and metal, and physics in superconductor will also be lectured.

1. Starting from what the electronic conduction is, an instruction of this lecture will be carried out including a separation from the classic conduction to the quantum conduction, and actual examples on the conductive devices.
2. Students will understand free electron models, Bloch functions, and crystal momentum, which are important concept in the electronic conduction, and they will learn the electronic conductive basic concept.
3. Students will learn a difference among metals, semi-metals, and insulators based on the understanding about the empty lattice approximation, and the state-density.
4. Students will understand semiconductors through a concept regarding the band gap of the semiconductors, motion equations in the crystal, difference between the electronic and Hall, and effective mass.
5. Students will more understand structure of the electronic band based on the effective mass with an actual example of band structure including a direct transition type GaAs, an indirect transition type Si, and Ge shown.
6. Students will learn details of the intrinsic (unique) semiconductors and electric conduction, the electronic state of a donor and acceptor in the impurity semiconductors, and the classical conductive mechanism.
7. Students will be introduced with actual examples regarding the compensation effects by the donor of the semiconductors and the acceptors, and they will more understand the impurity conduction which will be a base of a conductive device.
8. Summary of the first stage and exercise
9. Students will be explained about the Brillouin zone of metal and semiconductor, especially notation in the zone format, and they will learn the relationship between electrical conductivity and optical properties.
10. Students will be explained about the relation between Brillouin zones and Fermi surface, and they will understand the relationship between electrical conductivity and optical properties.
11. Students will understand the concept of electron orbitals, hole orbits, and open orbits. Students will learn basics of he strongly bound models as a summary of the understanding the concept on the electronic band.
12. Students will be introduced characteristics of superconductor.
13. Students will be explained about theoretical understanding of superconductor.
14. Students will learn about quantization of flux, quasi-particle and Cooper pair tunneling in superconductor.
15. Summary of the second stage
16. Exam

[Keywords] Energy dispersion, Energy band, Band gap, Semiconductor, Metal, Fermi surface, Band structure, Superconductor
[Textbooks and Reference Books] Charls Kittel, Solid State Physics, 8th edition, Book 1 & 2
[Evaluation] Overall evaluation to be based on mini-tests during the lectures, final exam and attendance etc.
[Related courses] Solid State Physics I, III, IV
[Course requirements] None in Particular
[Remarks] None in Particular

真空・ナノ薄膜工学　Vacuum　and Nano-Film Engineering
[Instructor](Masatomo Sumiya)
[Credits] 2
[Semester] 3rd year-Spring Thu 4
[Course code]T1S020001
[Room] Bldg.Eng.5-104
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Technologies of vacuum, thin-film are important basic technology covering nano-structure. In the lecture, students will first understand nature of the vacuum, and learn principles and methods for preparing and measuring vacuum. They will further discuss on a thin film formation method using the vacuum technology, and learn an evaluation method of the formed thin film and physics and application of the thin film.
[Course objectives] Students will understand a concept on the vacuum and thin film formation method. Students can operate vacuum equipment. They can form a thin film with an appropriate method. They can measure and evaluate the quality, physics, and functions of a thin film. They can examine and predict the features and function of the thin films.
[Plans and Contents]
1. Importance of vacuum and thin film　Characteristic of the vacuum, unit of pressure, ideal gas state equation
2. Basic law and formula for the gas I:Pressure and molecular speed, Maxwell Boltzmann distribution, velocity distribution law of gas
3. Basic law and formula for the gasⅡ: Stream of gas molecule, mean free path,
4. Vacuum creation and measurement: A kind and principle of the pump, principle of the pressure measurement device, vacuum apparatus design
5. Actual vacuum creation and measurement: conductance, the method of exhaust gas, time variation of pressure
6. The method of formation for thin filmⅠ: Outline of the film formation method, the vacuum deposition method, electric discharge in the vacuum
7. The method of formation for thin filmⅡ:Plasma basics and applications Sputtering, Plasma CVD:
8. The method of formation for thin filmⅢ Ion plating, the molecular beam epitaxy method, the heat CVD method
9. A thin film growth process: Surface adsorption, nuclear formation
10. Evaluation of thin filmⅠ:Film thickness, mechanical properties, Electrical properties,
11. Evaluation of thin filmⅡ:valuation of structure, composition
12. The type of thin filmⅠOptics film, dielectric film, Magnetic thin film
13. The type of thin filmⅡ.Organic film, semiconductor film, device process
14. 15. Function of thin film :Electronics and opto-electronics applications of thin film
15. 16. The End term Exam

[Keywords] Vacuum, thin film, pressure, flow speed, vacuum pump, pressure gauge, evaporation, plasma, sputtering
[Textbooks and Reference Books] “Hakumaku no kihongijutu” (3rd ed), A. Kinbara, Tokyo Daigaku Shuppan-kai
[Evaluation] Overall evaluation to be based on final exam, reports, attendance

表面物理化学　Surface Physical Chemistry
[Instructor] (Masatomo Sumiya)
[Credits] 2
[Semester] 3rd grade-Spring Thu 2
[Course code] T1S021001
[Room] Bldg.Eng17-213
[Course enrollment] 40
[Candidate] T1S021001
[Teaching description] Students will be explained about physical nature, and chemical nature of the solid surface, and they will be lectured with the introductory section of the evaluation method for the surface structure and the surface electron-state. Students will be lectured about outline regarding the physical chemistry from a view point of atoms and molecules in order to understand the basic principle, which is indispensable in the world of nanoscience.
[Course objectives] In nanoscience, the integration of the advanced knowledge on chemistry and physics is important. Any substances contact other substance systems at the surface boundary, and it is necessary for the students to understand phenomena occurring at the surfaces and the surface boundaries. Although the surface science is an ongoing academic work, it cannot be avoided to understand the basics of the nanoscience without the surface science. Students will obtain the basics of understanding properties of the surface and the surface boundary with the view of atoms and molecules, and they will master the basics to create new nanoscience.
[Plans and Contents]
1. Definition of surface: Introduction
2. Surface structure
3. Real and reciprocal space of a 2D lattice
4. Surface analysis I: Structural analysis using electron beam diffraction
5. Surface analysis II Observation of real images using a surface microscope
6. Surface dynamic behavior I: Adsorption
7. Surface dynamic behavior II: Adsorption process - Catalyst reaction-
8. Surface dynamic behavior III: -Surface oxidation-
9. Surface dynamic behavior IV: Crystal growth
10. Symmetry and group theory I: Symmetry elements and operations
11. Symmetry and group theory II: Point group rules
12. Symmetry and group theory III: Interaction with quantum mechanics
13. Symmetry and group theory IV: Application to dipole selection rule
14. Surface analysis III: Photoelectron spectroscopy and surface electronic state
15. Surface analysis IV Chemical composition analysis
16. Exam

[Keywords] Surface, Interface, Surface physics, Adsorption, Desorption, Diffusion, Surface analysis, Electron beam diffraction, Electron spectroscopy, Scanning tunnel microscopy, Group theory
[Textbooks and Reference Books] “Hyomen denshi bussei”, T. Kuroda, Nikkankogyo shinbunsha
[Evaluation] Overall evaluation to be based on mini-tests and final exam.
[Related courses] Material Chemistry for Nanoscience I (Physical Chemistry), Structural Analysis, Vacuum & Nano-film Engineering, Introduction to Solid State Physics I

ナノ計測科学　Science in Nano-Scale Measurement
[Instructor] Atsuo Sadakakta,
[Credits] 2
[Semester] 3rd year-Fall Wed 3
[Course code] T1S024001
[Room] Bldg.Eng17-112
[Course enrollment] Seating capacity of the classroom
[Candidate]Students of faculty of Engineering, Other Faculties, and Specially Registered Non-Degree Student.
[Teaching description] Students will be lectured about the basics of the electrical and electronic measurement which should be mastered in performing student experiments and graduate researches. Starting from the measurement of current and voltage, students will be lectured about measuring physical quantities by various sensors, and a method of analog to digital transformation, including a microscope and a scanning probe microscope used for observation in nanoscale
[Course objectives]　Students will first understand basic principle of the electronic measurement and basics of the measured value to be measured, and master the principles and technologies for quantitative measurement of physical quantity such as voltage, current, frequency, phase, magnetism, temperature, light, and mechanical quantity. They will also learn about the nanoscale observation technology in addition to this knowledge, and they will master the basics regarding nano measurement.
[Plans and Contents]
1. Basic concept of measurement
2. Measured value and data processing
3. Measurement error (cause of error, statistical treatment of error, measurement accuracy)
4. Measurement of physical quantity using an indicating instrument
5. Measurement of resistance
6. Alternating current measurement I
7. Alternating current measurement II
8. Digital measurement
9. Observation of waveforms
10. Basics of high frequency measurement
11. High frequency measurement
12. Signal conversion (analog conversion)
13. Digital processing
14. Nano-measurement technology I: Electron microscope
15. Nano-measurement technology II: Scanning probe microscope
[Keywords] Metrology, Signal processing, Sensor engineering, Nano-scale measurement
[Textbooks and Reference Books] Textbooks: “Denki-Denshi Keisoku”, Tadokoro Yoshiaki, Ohmsha, ISBN 4274205932, Reference Book: “Denjiki Keisoku”, CORONA PUBLISHING, ISBN 4339018287
[Evaluation] Evaluation to be based on attendance, reports, and results of final exam.

ナノ加工プロセス　Nanofabrication Process
[Instructor] Kunihiko Kasama
[Credits]2
[Semester]3rd year-Fall Thu 2
[Course code] T1S026001
[Room] Bldg.Eng17-112
[Course enrollment] Seating capacity of the classroom
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Students will learn focused on processing technology for ultrafine MOS LSI of which technology has been most established in order to learn a fabrication process at nanometer level. The students will comprehend the technology used in the world of MOS LSI, the challenges, development of the fabrication process, and wave in the future, so that they will understand how the technology is developed, and used in the actual industrial fields.
[Course objectives]　Students will comprehend where each of these technologies should be positioned, and factorized in the world of the technology where they will possibly be assigned as an occupation in future, instead of merely memorizing individual knowledge on the technology, so that they will master concepts to view in what type a technology will develop, and how this development should be captured.
[Plans and Contents] Students will learn a fabrication process of ultrafine MOSLSI as a typical example of nano-fabrication process which is a main issue of this class to understand how the technologies are progressing, where these technologies are positioned, and future challenges and wave; however, it is necessary to comprehend why these processing technologies are needed to learn the technology. For this, it is necessary at first that the students should comprehend the basic physics of the semiconductor materials and the basic operating characteristics of the device, and the challenges caused by miniaturizing the device. They will learn from the comprehension of positioning nano fabrication process technology.

1. Students will understand the physical structure of semiconductors from the establishment of the energy band structure they will learn basic physics of the semiconductor materials, mainly silicon.
2. They will understand the basic operating characteristics of p-n junction diodes, Schottky junction diodes, bipolar transistors, and MOS type field-effect transistor in the electron devices with which semiconductor materials are used. They will also overview the types of MOS LSI.
3. They will learn, as a development of MOS LSI, the trends in miniaturization and high performance as shown in Moore’s law, and rules of the device design, Scaling Rule, for promoting the miniaturization. They will also learn how the structure of MOS transistor has been transited, and supporting the miniaturization.
4. They will learn the fabrication flow, which is a basic structure of MOS LSI logic. They will learn about Planar technology and its development, and understand the characteristics of the semiconductor device manufacturing process.
5. They will an individual device process for fabrication of ultrafine MOS LSI including lithography, etching, introduction of impurities, forming a film, flattening, and substrate cleanup. They will make an attempt to understand the technologies including history of the development in each of the device technologies as much as possible.
6. They will also learn about the analysis evaluation technology necessary for the above devices, and the process technology development.
7. They will also learn the basic issues on the MOS LSI devices, and LSI circuit design. These basic issues will be also involved in the necessity of the process technology development.
8. They will learn that new challenges have come actualized in the state-of-the-art ultrafine MOS devices. They will learn that each effect and phenomena will be close to the physical limit, and understand further development, and expansion required.
9. They will also learn basic issues related to nanofabrication process, including compound semiconductor process, MEMS technology, new material technology, and FPD technology.
10. [Keywords] Ultrafine MOSLSI, Moore’s law, Scaling law, Planer technology, Lithography, Etching, Impurity implantation, Thermal oxidation, deposition, planarization, Cleaning, Multilayer process, Physical limitation, More Moore & more than Moore

[Textbooks and Reference Books] Text book (using text prepared by the lecturer) Reference book: S. M. Sze and Kwak K. Ng, “Physics of Semiconductor Devices” 3rd, Wiley-Interscience（2007）ISBN:9780471143239; A. S. Grove, “Physics and Technology of Semiconductor Devices” A Wiley International Edition（1967）
[Evaluation] Overall evaluation to be based on attendance and final exam.

数値解析　Numerical Analysis
[Instructor] KRUEGER PETER
[Credits] 2
[Semester] 3rd year-Fall Fri 5
[Course code] T1S027001
[Room] Bldg.IMIT - practice room 2
[Course enrollment] Seating capacity of the classroom
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Course objectives]
Basic problems of numerical analysis are introduced and simple methods to solve them are studied using the Mathematica software. Second, the numerical solution of concrete physics problems from mechanics, electromagnetism, and quantum mechanics will be practiced
[Teaching description]
In the first half, the principles of important problems of numerical analysis are discussed and basic methods for their solution, as well as the corresponding algorithms are presented. Using the Mathematica software, simple programs are written to practice these problems. In the second half, the objective is that the students can solve basic physics problems independently. The problems are taken from mechanics (oscillator), electromagnetism (electrostatic field) and quantum mechanics (1 dimensional Schroedinger equation).
[Plans and Contents]
1. Guidance, Principles of numerical analysis, Errors.
2. Practicing basic functionalities of Mathematica
3. Non-linear equations
4. Numerical derivation and integration
5. Ordinary differential equations
6. Harmonic oscillator
7. Anharmonic oscillator, Fourier transform
8. Mid-term test
9. Partial differential equations
10. Problem in electrostatics
11. Problem in electrostatics
12. Matrix eigenvalue problems
13. Schroedinger equation dimensional potential well
14. Potential step, scattering
15. Final exam

[Keywords] Methods of numerical computation, Mathematica software.
[Textbooks and Reference Books] Reference books:
Numerical Recipes: the art of scientific computing. http://www.nr.com/
Robert Zimmerman and Fredrick I. Olness: Mathematica for physics, Addison-Wesley.
[Evaluation] Attendance and homework reports (30%), mid-term exam (30%) , final exam (40%)
[Related Course]
Electromagnetism, Quantum mechanics I+II, Mathematical Physics.
[Course requirements]
Taking Quantum mechanics I+II, Mathematical Physics I+II.
[Remarks] The class will be taught in English.

物質結合論　Chemical Bond Theory
[Instructor] Kaori Niki
[Credits] 2
[Semester] 3rd year-Fall Mon 3
[Course code] T1S028001
[Room] 121 ※121is the Lecture room of 1st building in Faculty of Science
[Teaching description] Students will coherently discuss on an electron state of atoms, molecules, and solids under independent particle approximation. Mathematics to be used is limited to something elementary.
[Plans and Contents]
1. Chapter 4 Atoms
2. Chapter 4 Atoms
3. Chapter 5 Molecules and electron state of solid body
4. Chapter 5 Molecules and electron state of solid body
5. Chapter 5 Molecules and electron state of solid body
6. Chapter 5 Molecules and electron state of solid body
7. Chapter 5 Molecules and electron state of solid body
8. Chapter 5 Molecules and electron state of solid body
9. Chapter 5 Molecules and electron state of solid body
10. Chapter 6 Surface and impurity level
11. Chapter 6 Surface and impurity level
12. Chapter 6 Surface and impurity level
13. Nucleus movement and electron movement
14. Nucleus movement and electron movement
15. Nucleus movement and electron movement
16. Test
[Textbooks and Reference Books] Takashi Fujikawa, “Schrödinger equation for primarychemist” SHOKABO
[Evaluation] Reports and Exam
[Related courses] Spectrochemistry, Physical Chemistry

ナノ物性科学実験 Ⅰ　NanoMaterial Laboratory I
[Instructor] Each teacher
[Credits] 3
[Semester] 3rd year-Spring 3, 4, 5
[Course code] T1S029001, T1S029002, T1S029003
[Room]
[Course enrollment] Limited by the size of the laboratory and number of test equipment (42)
[Candidate] Department of Nanoscience
[Teaching description] Students will perform experiments of physics measurement, electric measurement, and physical chemistry into a group.
[Course objectives] They will master basic attitude to the experiments through each of the experiments, and train right knowledge, careful insight ability, and judgment. They can comprehend the basic principles of various phenomena in nanoscience, and quantitatively evaluate them. They can correctly summarize the data on the experiments, and write a report. They can make a presentation of the summarized experiment data as easy as possible to perceive.
[Plans and Contents] Students will select a theme from the following ones and perform an experiment with one theme twice. 1) Calculation for science and technology (electronic state), 2) drawing, 3) operational amplifier, 4) heat [thermo-couple: electrostatic transducer, thermal conduction], 5) interaction between light and materials (solar cells), 6) digital circuit, 7) programing and data processing using a personal computer, 8) diffraction experiment (X-ray diffraction), 9) magnetization characteristics of ferromagnetic material, 10) engineering work technology, 11) optical response of semiconductor, 12) EL 13]: FET + photo lithography + Vacuum, 14) SEM, 15) equilibrium potential of solutions, 16) adsorption

1. Guidance, error theory, safety training
2. Experiment (Theme1 First Experiment)
3. Experiment (Theme1 2nd Experiment)
4. Experiment (Theme2 First Experiment)
5. Experiment (Theme2 2nd Experiment)
6. Experiment (Theme3 First Experiment)
7. Experiment (Theme3 2nd Experiment)
8. Experiment (Theme4 First Experiment)
9. Experiment (Theme4 2nd Experiment)
10. Experiment (Theme5 First Experiment)
11. Experiment (Theme5 2nd Experiment)
12. Experiment (Theme6 First Experiment)
13. Experiment (Theme6 2nd Experiment)
14. Preparing presentation
15. Presentation

[Textbooks and Reference Books] Prepared text wiil be distributed.
[Evaluation] Reports 80%, attendance 20% provided all reports are submitted without exception.
[Course requirements] Credits for Applied Physics Laboratory I and II must be obtained.

ナノ物性科学実験 II　NanoMaterial Laboratory II
[Instructor] Each teacher
[Credits] 3
[Semester] 3rd year-Fall Tues 3, 4, 5
[Course code]T1S030001, T1S030002, T1 S030003
[Room]
[Course enrollment] Limited by the size of the laboratory and number of test equipment (42)
[Teaching description] Physical measurement, electrical measurement and physical chemistry experiments shall be divided and then carried out by the different groups.
[Course objectives]　Acquire basic experimental skills and cultivate the right knowledge, a keen sense of observation and assessment capability through the various experiments. Derive an understanding of the basic principle of the various phenomena in nanoscience and be able to perform quantitative evaluation. Learn how to summarize the experimental results and write a report correctly. Be able to present the summarized experimental results in an easy-to-understand manner.
Teaching Plans and Teaching Contents] Students will select a theme from the following ones and perform an experiment with one theme twice. 1) Calculation for science and technology (electronic state), 2) drawing, 3) operational amplifier, 4) heat [thermo-couple: electrostatic transducer, thermal conduction], 5) interaction between light and materials (solar cells), 6) digital circuit, 7) programing and data processing using a personal computer, 8) diffraction experiment　(X-ray diffraction), 9) magnetization characteristics of ferromagnetic material, 10) engineering work technology, 11) optical response of semiconductor, 12) EL 13]: FET + photo lithography + Vacuum, 14) SEM, 15) equilibrium potential of solutions, 16) adsorption

1. Factory visit
2. Experiment (Theme 1 First Experiment)
3. Experiment (Theme 1 2nd Experiment)
4. Experiment (Theme2 First Experiment)
5. Experiment (Theme2 2nd Experiment)
6. Experiment (Theme3 First Experiment)
7. Experiment (Theme3 2nd Experiment)
8. Experiment (Theme4 First Experiment)
9. Experiment (Theme4 2nd Experiment)
10. Experiment (Theme5 First Experiment)
11. Experiment (Theme5 2nd Experiment)
12. Experiment (Theme6 First Experiment)
13. Experiment (Theme6 2nd Experiment)
14. Preparing presentation
15. Presentation

[Textbooks and Reference Books] Prepared text will be distributed.
[Evaluation] Reports 80%, attendance 20% provided all reports are submitted without exception.
[Course requirements] Credits for Applied Physics Laboratory I and II must be obtained.

集積回路 Integrated Electronic Circuit
[Instructor] Ken-ya Hashimoto
[Credit] 2
[Semester] 3rd year-Fall　Wed 4
[Course code] T1S031001
[Room] Bldg. Eng. 17- 213
[Course enrollment] about 150
[Candidate]Students of faculty of Engineering
[Teaching description] Students will study a circuit structure in a semiconductor integrated circuit, and an electronic circuit using the circuit structure, including the basics with design outline.
[Course objectives] Starting from the basics of an analog electronic circuit, students will master basic concept of a calculation amplifier, and learn specific circuit structure method with linear and nonlinear type calculation and an oscillating circuit as materials. An electronic circuit simulation based on SPICE and Verilog HDL will be also referred to. A structure method of a digital circuit having more complex functions and application of digital elements including a microprocessor will be also referred to.
[Plans and Contents]

1. Basics of electric circuits (bipolar transistor and FET operation, basic amplifying circuits, bias and the small-signal model)
2. Basics of electric circuits (operating point analysis, small-signal analysis, push-pull amplification, power amplification)
3. Basics of electric circuit design (simulation using PSpice, amplifying circuit design)
4. Basics of electric circuit design (current mirror circuits, differential amplifiers)
5. Basics of op-amps (basic op-amps and negative feedback operation)
6. Basics of op-amps(simulation using PSpice, and more complex op-amp circuit design)
7. Positive feedback and oscillator circuits (positive feedback operation, basic oscillator circuits and their analysis)
8. A/D and D/A converters (various A/D and D/A conversion circuits and their analysis)
9. Digital circuit elements (implementing various functions through basic element combinations)
10. Digital circuit design (simple function implementation and simulation using Verilog HDL)
11. Digital circuit design (advanced function implementation and simulation using Verilog HDL)
12. Functionality from microprocessors (implementing functions through microprocessor basics and software.)
13. Basics of high-frequency circuits (electronic element behavior in high-frequency circuits and basic circuit construction)
14. Basics of high-frequency circuits (Basics of high-frequency circuit design)
15. Communication application for high frequency circuits

[Keywords] Electronic circuit, integrated circuit, operational amplifier, analog, digital, microprocessor, SPICE
[Evaluation] Evaluation will be given by reports(4times).
[Course requirements] Students must have preferably taken courses of Introduction to computer hardware, and Elementary Electronic Circuit.
[Remarks]Electric circuit problem sets will be completed using circuit simulator Qucs, students need access to a PC with MS Windows OS installed.

専門外国語 English for Engineering
[Instructor] Each teacher
[Credits] 2
[Semester] 3rd year-Spring Wed 3
[Course code] T1S032001
[Room] Bldg.Eng2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Teaching description] Students will be lectured about and take exercises on English to be required in learning Nano Science.
[Course objectives] They will listen to the lectures with easy description in specialized English, and be able to understand what are described. They will read text books with easy description in specialized English, and will be able to understand what are described.
[Plans and Contents]
1. Guidance, basics of engineering English
2. Video viewing
3. Lecture
4. Video viewing
   Lecture
5. Video viewing
6. Lecture
7. Video viewing
8. Reading of English text
9. Reading of English text
10. Reading of English text
11. Reading of English text
12. Reading of English text
13. Reading of English text
14. Reading of English text, Exam

[Evaluation] Attendance・Presentation・Reports・Exam

物性物理科学 III　Introduction to Solid State Physics III

[Instructor] Takashi Fujikawa
[Credits] 2
[Semester] 4th year-Spring Fri 2
[Course code] T1S034001
[Room] Bldg.Eng.2-102
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Lecture on magnetism in solid states materials, relevant to nanoscience, along a textbook "Introduction to Solid State Physics (Latter part)" by Kittel.
[Course objectives] Understanding of properties and their underlying physics of materials related with nanoscience.
[Plans and Contents] Using introductory book by Kittel "Introduction to Solid State Physics (Latter part, 8th ed.)" through chapter 11 to 13, those basic of paramagnetism and anti- paramagnetism, ferromagnetism and anti-ferromagnetism, and nuclear magnetic resonance will be lectured
[Keywords] paramagnetism, anti- paramagnetism, ferromagnetism, anti-ferromagnetism, nuclear magnetic resonance
[Textbooks and Reference Books] “Kotaibutsurigaku Nyumon(8th ed.)”, C. Kittel, Maruzen
[Evaluation] Overall evaluation to be based on mini-tests during the lectures, reports, attendance etc.
[Related courses] Introduction to Solid State Physics I,II,IV

物性物理科学 IV　Introduction to Solid State Physics IV
[Instructor] Toshio Matsusue
[Credits] 2
[Semester] 4th year-SpringThu 3
[Course code]T1S035001
[Room] Bldg.Eng.5-104
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Lecture on dielectric and optical phenomena and their fundamentals in solid states materials, relevant to nanoscience, along a textbook "Introduction to Solid State Physics (Latter part)" by Kittel.
[Course objectives] Understanding of properties and their underlying physics of materials related with nanoscience.
[Plans and Contents]
Basics of dielectric function, plasmon, polariton, polaron, optics processes, exciton, dielectric and ferroelectric materials will be discussed.
[Keywords] dielectric function, dielectric material, ferroelectric material, optical process, Plasmon, polariton, polaron
[Textbooks and Reference Books] “Kotaibutsurigaku Nyumon(8th edition)”, Kittel, Maruzen
[Evaluation]　Overall evaluation to be based on attitude, experiments, mini-tests, reports, etc.
[Related courses] Introduction to Solid State Physics I,II,III,　Introduction to Quantum Mechanics, Introduction to Electromagnetism 1 & 2

ナノ物性科学セミナーＩ　Seminar　on Solid-State Nanophysics　I
[Instructor]　Each teacher
[Credits] 2
[Semester] 4th year-Spring Intensive
[Course code]T1S037001
[Room] Each laboratory
[Teaching description] A seminar to be held in each laboratory, for research of nanoscience (graduation research)
[Course objectives] Students will master necessary knowledge on nanoscience (graduation research)
[Plans and Contents] The content varies according to a laboratory.
[Keywords] graduation research
[Evaluation] They will be collectively evaluated with attendance, attitude, and presentation in the seminar.
[Related courses] Graduation Research
[Course requirements] They take, or have already taken a course of Graduate Research.

ナノ物性科学セミナー II　Seminar on Solid-State Nanophysics　II
[Instructor]　Each teacher
[Credits] 2
[Semester] 4th year-Fall Intensive
[Course code] T1S038001
[Room] Each laboratory
[Teaching description] A seminar to be held in each laboratory, for research of nanoscience (graduation research)
[Course objectives] Students will master necessary knowledge on nanoscience (graduation research)
[Plans and Contents] The content varies according to a laboratory.
[Keywords] graduation research
[Evaluation] They will be collectively evaluated with attendance, attitude, and presentation in the seminar.
[Related courses] Graduation Research
[Course requirements] They take, or have already taken a course of Graduate Research.

特許法概論　Introduction of Patent Law
[Instructor] (Hiroyuki Kurihara)
[Credits] 2
[Semester] 3rd year-Spring-Thurs 2
[Course code] T1M131001
[Room] Bldg. ENG-2-202
(Bldg. ENG-2 cannot be used during 2014 fall semester.)
[Teaching description] This lecture will focus on the basic knowledge about intellectual property rights, especially patent laws, and basic analysis of intellectual property right system of each country.
[Course objectives] The explanation will be about the knowledge on intellectual property rights especially for patent law that is necessary outside the community of undergraduates.　While touching the background of the so-called pro-patent era, we will incorporate much information about intellectual property activities in the enterprise.　Then, since international relationship is also important, there will also be some basic instructions of intellectual property right system of each country. With the aim to understand the intellectual property rights after the lecture is over, the student will be able to understand things based on the perspective of the actual ownership.　Furthermore, the student will also be able to investigate on the patent.
[Plans and Contents] Lectures are conducted based on printouts. Students are to check up on terms used in each lecture topic before attending the lesson and go through the distributed materials again after the lecture to check if there any points that they are not clear about.

1. Intellectual property system [patents, utility model, design, trademark, copyrights, Unfair Competition Prevention Law]
2. Objective and structure of patent system
3. Procedure from patent application to patent award
4. Inventions that can be patented, patentability assessment 1
5. Inventions that can be patented, patentability assessment 2
6. Reading of official bulletins, public inventions – infringement of rights, technical scope
7. Patent investigation, use of patents
8. Use of intellectual property and corporate initiatives, readiness of research staff
9. Utility models, designs, trademarks, copyrights
10. Foreign applications 1
11. Foreign applications 2
12. From invention to patent application
13. Procedure from patent application to being patented
14. Implementation of invention and rights infringement
15. Summary of patent law, end-of-term exam

[Keywords] Patent, utility model, design, trademark, copyright
[Textbooks and Reference Books] Handouts provided in every lecture
[Evaluation] Evaluated on attendance and exams. Attendance 40points, Exams 60 points. On the exams, checking understanding of property rights and patent law.
[Remarks] 4th year students of Department of Nanoscience may take this course.

プレゼンテーション技法　Presentation Techniques

[Instructor]Kazunuki Yamamoto

[Credits]2

[Semester] 4th year-Fall Mon 4

[Course code] T1S040001

[Room] Bldg.Eng.2-102

(Bldg. ENG-2 cannot be used during 2014 fall semester.)

[Teaching description] Students will learn basic technics on presentation with lectures and practices.

[Course objectives] They will master technics necessary for the presentation of a graduate research, and a presentation at the companies

[Plans and Contents]

1. Basic presentation knowledge
2. Familiar preparation (1) Introduce of your classmate. Information gathering (focus on interview), Information arrangement, set a punchline, Actual presentation
3. Familiar preparation (2) Explanation of your name. Information gathering (focus on textbook and internet) Information arrangement set a punchline, Actual presentation
4. Creation of idea (1) Basic brainstorming
5. Creation of idea (2) Actual brainstorming and mind map
6. Organizing problem (1) Basic of KJ method
7. Organizing problem (2) Actual of KJ method
8. Factorial analysis for problem point (1) Basic of Characteristic Diagram
9. Factorial analysis for problem point (2) Actual of Characteristic Diagram
10. Preparation for experiments and research (1) differences between normal presentation and academic Presentation. The method of drawing Chart and Table. Accuracy, Compromise, Ethics
11. Preparation for experiments and research (2) Improvement for student experiment presentation (data processing, reverification of the result)
12. Preparation for experiments and research (3) Improvement for student experiment presentation (Expression, Contents of ethic, Set a punchline)
13. Preparing for graduation speech (1)
14. Preparing for graduation speech (2)
15. Conclusion

[Evaluation]Overall evaluation will be given by attendance, attitude for the class and presentation.

[Remarks] Basically, the student must have presentation in every this lecture.

ナノ・分子物性研究（卒業研究）Graduation Research
[Instructor] Each teacher
[Credits] 8
[Semester] 4th year grade-Spring Fall
[Course code]: T1S041001
[Room] Each laboratory
[Teaching description] Graduation research, writing of graduation thesis, presentation of graduation thesis.
[Course objectives] Students will be able to perform themselves a series of research processes including a plan, preparation, execution, and conclusion through a graduation research.
[Plans and Contents] Contents vary depending on the research lab.
[Keywords] Graduation research
[Evaluation] They will be collectively evaluated with attendance, attitude, graduation thesis, and presentation of the graduation research.
[Related courses] Seminar on Solid-State Nanophysics I, II
[Course requirements] They take, or have already taken a course of Seminar on Solid-State Nanophysics I II

先端科学特別研究　Advanced　Scientific Research
[Instructor] Kazunuki Yamamoto
[Credits] 2
[Semester] 3rd year-Spring Fall
[Course code] T1S042001
[Room]
[Course enrollment] about 5
[Teaching description] Students will perform a research activity individually or in a group.
[Course objectives] They will be able to perform themselves a series of research processes including a plan, preparation, execution, and summary
[Plans and Contents] They will experience with performing themselves a series of research processes including a plan, preparation, execution, and summary they will also perform a presentation at a research presentation to be held at the end of the fiscal year
[Evaluation] Overall evaluation to be based on attendance, attitude during the seminar, presentations, etc.
[Related courses] Project Research I,II
[Course requirements]Must have finished Project Research I & II as a matter of principle.

光デバイス Electronic Devices
[Instructor] Ken Morita
[Credits] 2
[Semester] 4th year-Spring 3
[Course code] T1S043001
[Room] Bldg.Eng - 17-213
[Course enrollment] 30
[Candidate] 4th year
[Teaching description]
Students will learn the description of the optical refraction, reflection, transmission and absorption based on the classical and quantum-theoretical methods. They will be particularly described about interaction between a substance and light regarding the absorption, the radiation, and the reflection classically and quantum-theoretically to learn the basic knowledge necessary for applying the light to the field of the engineering. They will also learn the operating principles for the semiconductor optical devices to be used for the optical communications such as semiconductor laser, light emitting diodes, and optical fiber systems.
[Course objectives] Students will understand the property that the light has from both classical side and quantum-theoretical side. They will understand the phenomena regarding the generation, the reflection, and the absorption of the light, and the mechanism thereof. They will also learn the operating principles for the semiconductor optical devices to be used for the optical communications.
[Plans and Contents]
Class 1. Explain the course, methods, and evaluation in the course regarding optical phenomena and optical devices. Explain how the content of this course is placed in the scientific/engineering fields of electricity and electronics, then start with an explanation of physical phenomena such as absorption, emission, scattering, and reflection of light, and optical devices used in daily life such as light-emitting diodes. Class 2.3. Classical properties of light – explain the propagation of light. Describe polarization and other classical properties. Explain reflection and refraction of light. Class 4.5 Classical properties of light – explain the coherence and interference of the light. Also explain the optical dispersion of the dielectric constant based on the classical model. Class 6.7 Classical properties of light – explain the light wave propagation of the optical waveguide. Class 8 exam. Class 9.10 Interaction of light and matter –Explain the optical absorption, spontaneous, and stimulated emission for the 2-level states. Class 11-13 Lasers – learn more about interaction between light and matter, and derive the oscillation condition for the lasers originating from the light amplification due to the stimulated emission. Explain the structures and operating principle for the semiconductor lasers in terms of light amplification and oscillation conditions. Class 14. Optical communication devices – discuss future trends in high-speed modulation elements and other advanced optics used in optical communication in other optical devices.

1. Daily optical phenomena and optical devices
2. Classical properties of light 1 – optical propagation
3. Classical properties of light 2 – refraction, reflection, and transmission
4. Classical properties of light 3 – refraction, reflection, and transmission
5. Classical properties of light 3 – coherence and interference
6. Optical propagation in the waveguide 1
7. Optical propagation in the waveguide 2
8. Practice
9. Interaction of light and matter 1
10. Interaction of light and matter 2
11. Lasers 1
12. Lasers 2
13. Lasers 3
14. Optical communication and other optical device
15. Exam

[Keywords] optical refraction, reflection, transmission, interference, and coherence, stimulated emission, semiconductor band structure, semiconductor laser
[Textbooks and Reference Books]
Text books: Introduction to Optoelectronics, Hiroshi Nishihara Shogo Ura (Oh-mu-sha)
Reference: Optoelectronics, Amnon Yariv, Pochi Yeh (Maruzen)
[Evaluation] Report and Exams
[Related courses] Electromagnetic Theory, Quantum Mechanics, Semiconductor Physics

[Course requirements] Students are recommended to review have taken Intro to Quantum Mechanics, Intro to Materials Science, and Physical Properties of Semiconductors.

インターンシップ Ⅰ　Internship I
[Instructor] Kazuyuki Sakamoto
[Credits] 1
[Semester] 3rd & 4th -Spring Fall
[Course code] T1S044001
[Room]
[Teaching description] Undergo internship training at a company.
[Course objectives] Acquire practical knowledge that cannot be learned in the university through actual work experience in a company.
[Plans and Contents] Vary depending on the company.
[Evaluation] Overall evaluation to be based on individual report and report by the internship company.

インターンシップ II　Internship II
[Instructor] Kazuyuki Sakamoto
[Credits] 1
[Semester] 3rd &4th year-Spring, Fall
[Course code] T1S045001
[Room]
[Teaching description] Undergo internship training at a company.
[Course objectives] Acquire practical knowledge that cannot be learned in the university through actual work experience in a company.
[Plans and Contents] Vary depending on the company.
[Evaluation] Overall evaluation to be based on individual report and report by the internship company.

基礎半導体工学　Fundamental Semiconductor Engineering
[Instructor] Nobuyuk i Aoki, Hiroyuki Bando
[Credits] 2
[Semester] 3rd year-Spring 2
[Course code] T1S046001
[Room] Bldg.Eng.17-112
[Course enrollment] about 50
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] In this lecture, students will learn the basics of the operating mechanism and structure for semiconductor devices which are the most important. At the beginning of half lecture, will be lectured for the intrinsic semiconductors, p-type and n-type semiconductors, metal-semiconductor junction, p-n junction, bipolar transistors, and field effect transistors. In remain of half lecture, lecture with practice about the introduction of electronic circuit using the transistor.
[Course objectives] It is aimed for the acquisition of the basic knowledge that must understand an operation of semiconductor device which is necessary for a student experiment and graduation research.
Especially, the lecture in 6th of semester for obtaining the back ground for lectures of the nano-fabrication process.
In this lecture, the details of such as the origin of the band gap, band structure in a semiconductor will not be discussed. The detail will be learnt in Solid State Physics I, II.
[Plans and Contents]
In lecture from the 1st to 10th times, the structure of the semiconductor and the basic characteristics will be lectured by N. Aoki. In lecture from the 11th to 15th times, basic electronic devices and analog circuit using semiconductor elements will be introduced by H. Bando.

1. The outline of the band theory: Energy band structure, an electron and hole
2. A carrier of semiconductors: Density of state and distribution function, intrinsic, n-type, p-type semiconductor
3. Electrical conduction I in semiconductor: Effective mass, drift conduction and diffusion conduction
4. Electrical conduction II in semiconductor: The thermal excitation, recombination, and photo-excitation of carrier
5. P-n junction I: Energy band diagram of the p-n junction, current-voltage characteristics
6. P-n junction II: Electric potential distribution and capacitance-voltage characteristics, relation of light and p-n junction in a depletion layer
7. Metal - semiconductor junction: Schottky contact and current-voltage characteristics, ohmic contact
8. Bipolar transistor: Characteristic of structure, grounded base and emitter circuit
9. Field effect transistor: Comparison between Principle of FET and comparison between former bipolar transistor and FET
10. Summary of the first half part, mid-term exam
11. Introduction of the semiconductor device: Photoconduction effect, Seebeck effect, Peltier effect
12. Analog electronic circuit using the semiconductor element: Transistor basics amplification circuit (grounded base and grounded emitter circuit)
13. Negative feedback amplification circuit: A principle and effect of the negative feedback
14. Op-amp: Circuit using a characteristic of the negative feedback and effects of op-amp
15. Basics of integrated electronic circuit: Class A amplifier, Class B push-pull amplifier
16. Summary of the latter half, term-end examination

[Keywords] Crystal structure, energy band, electron and hole, intrinsic semiconductor, n- and p-type semiconductor, mobility, conduction band, valence band, forbidden band, Fermi level, Fermi-Dirac function, effective mass, effective density of state, minority- and majority carrier, Einstein formula, p-n junction, Schottky junction, depletion resion, diffusion current, diffusion length, junction capacitance, Hall effect, basic absorption edge, direct- and indirect-band gap, photo-electron effect, Seebeck effect, Peltier effect, bipolar transistor, FET, grounded emitter, ground base, solar cell, semiconductor laser
[Textbooks and Reference Books] Textbook: Hiroyuki Matsunami “Handoutaidebaisu” ISBN4-320-08582-5, Kyoritsu-publishing, Reference Books: Akio Kumioka, kiichi Kamimura “Shinban Kisohandoutaikougaku” ISBN978-4-254-22138-1, Asakura Publishing, Teruo Tamai “Zukainiyoru Handoutaidebaisunokiso” ISBN:978-4-339-00632-2, Coronasha
[Evaluation] Evaluation to be based on attendance, reports, and results of mid-term and end exam.
[Remarks] The students will be preferred taken the course of Electric Circuit Theory
[Related courses] Electronics Devices,Nanofabrication Process,Introduction to Solid State physics II

国際実習　International Research Program
[Instructor] supervising teacher
[Credits] 1
[Semester] 2nd-4th year-Spring　Fall-Intensive
[Course code] T1S047001
[Room]
[Teaching description] This is a course to acknowledge international activities such as international conferences related to nano science that are held overseas, practical training in overseas research institutions such as universities and research centers and Internship in company overseas.
[Course objectives] The course aims to cultivate the students’ skills in advancing international activities and widen the students’ perspective through practical training overseas such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies and so on.
[Plans and Contents] International activities such as international conferences, practical activities and workshops in overseas research institutions like universities and research centers, short-term overseas studies, overseas oral presentations, practical work and report writing upon return and so on will be the subject of evaluation for the certification.preparation,report writing,presentation for practical activities in oversea are calculated.
[Evaluation]　Evaluation shall be carried out by the supervising faculty member or program teaching staff and credits shall be awarded based on submitted documents.
[Remarks] Those who wish to register for the International Practical Training I should not register for this course. Those who passed the evaluation criteria after the practical training will be registered for the course subsequently by the faculty member in-charge. The schedule and country need to be discussed with your instructor before you go.　With International practical training can be taken even if the upper limit of the number of registered credits has been reached. (These credits will not be counted in the registered credit limit)And also, ordinary language study in abroad is not evaluated by this course.

造形演習　Design Aesthetics(Lab.)
[Instructor] Akira Ueda
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016001
[Room] Bldg.Eng.2- 201
[Teaching description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives]　Specific objectives of this course are as follows: (1) to cultivate the attitude to learn; (2) to develop multilateral observation skills; (3) to recognize the existence of various solutions; (4) to enhance presentation skills. In the Design Aesthetics (Lab.) course, students are required to challenge each of these 4 assignments, and continue until they achieve satisfaction. Students will learn to associate their brain and hands, and "move their hands, work up a sweat, let imagination loose, and create."
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assignment 3: Production of a tabletop lamp shade.
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
12. Assignment 4: Modeling of flying object.
13. Assignment 4: Seminar.
14. Assignment 4: Criticism.
15. Exhibition, summary, and criticism.

[Keywords] Observation, Thinking, Design, Presentation
[Textbooks and Reference Books] Not particularly.
[Evaluation] Evaluation is given by attendance works, and presentation.
[Related courses] Not particularly
[Course requirements]　Not particularly
[Remarks] Not particularly

造形演習　Design Aesthetics(Lab.)
[Instructor] Takatoshi Tauchi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016002
[Room]Innovation Plaza, Faculty of Engineering
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Pencil sketch of a hand.
3. Assignment 1: Seminar.
4. Assignment 1: Seminar・Criticism.
5. Assignment 2：:Sketch of a solid object based on the three orthographic views.
6. Assignment 2: Seminar・Criticism
7. Assignment 3：Production of elastic band driven car.
8. Assignment 3: Seminar: Presentation of work based on the research findings.
9. Assignment 3: Production
10. Assignment 3: Presentation.
11. Assignment4: Production of a paper sandal.
12. Assignment4:：　Presentation of work based on the research findings.
13. Assignment4: Production
14. Assignment 4: Presentation.
15. Exhibition and criticism.

[Evaluation] Evaluation is comprehensively given by attendance, works, and the quality of presentation.
[Remarks] Wearing sandals and high-heeled shoes are strictly prohibited in Innovation Plaza, Faculty of Engineering

造形演習　 Design Aesthetics(Lab.)
[Instructor] Yoichi Tamagaki, Yoshihiro Shimomura
[Credits]　2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016003
[Room] Bldg.Eng..2–atelier(2–601）
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member. [Plans and Contents]
[Evaluation]

造形演習　Design Aesthetics(Lab.)
[Instructor] Yosuke Yoshioka
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016004
[Room] Bldg.Eng 1- 110
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
[Evaluation]

造形演習　Design Aesthetics(Lab.)
[Instructor] Ueda Edilson Shindi
[Credits] 2
[Semester] 1st year-Spring-Tues 5
[Course code] T1Y016005
[Room] Bldg.Eng.2- 102
[Course enrollment] 60
[Candidate] Students of Faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student
[Teaching description] Engineering is manufacturing, and manufacturing is a formative activity. The Design Aesthetics (Lab.) course aims to evoke students' interest in Engineering = manufacturing through several formative design projects and to awaken the individual talents in formative arts.
[Course objectives] When awareness towards an issue leads to some form of result by an engineering means, making something with a better organized form in mind and making something without such cognition will produce very different results. Through exercise, students will learn what better organized forms are. In specific, students will be given assignments for each item shown in the course plan based on the specialized areas of the faculty member.
[Plans and Contents]
1. Overall guidance.
2. Assignment 1: Precision drawing using a pencil.
3. Assignment 1: Seminar.
4. Assignment 1: Criticism.
5. Assignment 2: Drawing of a solid object based on the elevation drawing.
6. Assignment 2: Seminar.
7. Assignment 2: Criticism.
8. Interim presentation
9. Assessment 3: Select a theme from water, fire, soil, or wind, and freely create a form
10. Assignment 3: Seminar.
11. Assignment 3: Criticism.
12. Assignment 4: Seminar.
13. Assignment 4: Criticism.
14. Exhibition

[Keywords] Observation, Thinking, Design, move their hands, work up a sweat, let imagination loose, and create Presentation
[Textbooks and Reference Books] Not particularly
[Evaluation] Evaluation is given by attendance, works and quality of presentation. Attendance 40%, Presentation 60%.
[Related courses] Not particularly
[Course requirements]　Not particularly
[Remarks] Not particularly

工学倫理　Engineering Ethics
[Instructor] Kenta Ono
[Credits] 2
[Semester] 3rd year-Fall-Mon 5
[Course code] T1Z051001
[Room] Large Lecture Room
※Large Lecture Room is located in 2nd Building of Faculty of Educations,
[Candidate] 2nd to 4th year of Faculty of Engineering (Direction is given by each Department)
[Teaching description] Engineering is a practical area of learning that utilizes various scientific and technological achievements to enhance our lives and living environment. However, if used in an inappropriate manner, it will create major social dislocations and loss which may even jeopardize our personal lives. This course discusses the missions, norms, roles, rights and responsibilities of engineers in relation to the society from a broad perspective.
[Course objectives] The objective of this course is to acquire the basic concepts and knowledge for engineers to promote the advancement of technology and contribute to society based on sound ethics.
[Plans and Contents] * The schedule and contents are subject to alteration.

1. Introduction to ethics (Kyuichiro Takahashi, Center of General Education, Chiba University)
2. Characteristics of engineering ethics (Keizo Kutsuna, the Center for General Education, Chiba University)
3. Compliance and general principles of ethics (Moriyoshi Konami, professional engineer)
4. Product liability (Moriyoshi Konami, professional engineer)
5. Whistleblowing (Moriyoshi Konami, professional engineer)
6. Resolving ethical problems (Moriyoshi Konami, professional engineer)
7. Preparedness as an engineer and professional (Moriyoshi Konami, professional engineer)
8. Information technology and copyright: Private sound recording and the Copyright Levy Framework for audiovisual recordings (Heitoh Zen, Institute of Media and Information Technology, Chiba University)
9. 109. Proprietary rights including intellectual property rights (1) (Masayoshi Takahashi, patent attorney)
10. Proprietary rights including intellectual property rights (2) (Masayoshi Takahashi, patent attorney)
11. Proprietary rights including intellectual property rights (3) (Masayoshi Takahashi, patent attorney)
12. Natural resource consumption and environmental ethics (Motoi Machida, Safety and Health Organization, Chiba University)
13. Safety and risks (1) (Yukinobu Shinoda, Industrial Safety Consultant)
14. Safety and risks (2) (Yukinobu Shinoda, Industrial Safety Consultant)
15. Group Discussion (Education committee member of each department)

[Keywords] Mission of engineers, morals, obligations, discipline, and engineering ethics.
[Textbooks and Reference Books] 1) Norifumi Saitoh et al., HAJIMETE NO KOUGAKU RINRI (Introduction of Engineering Ethics) second edition, Showado, (2005), 1400 yen + Tax, 2) Taiji Sugimoto et al, GIJYUTUSHA NO RINRI NYUMON (Introduction of ethics for engineer) fourth edition, Maruzen Publishing Co., Ltd., (2008), 1700 yen + Tax
[Evaluation]
Students will be assessed by results of mini-tests at the end of each lecture. Students must attend a minimum of 12 lectures for accreditation. The yes or no entry to Moodle is treated as attendance. Students need to answer it during every review time.
[Course requirements]
Refer to syllabus available online for subject categories of each faculty. Consult a faculty member of Board of Education when the information is not available.
[Remarks] Lecture schedule and contents are subject to alteration depending on availability of lecturers. Students are required to attend the guidance session to be held on the first class.

工業技術概論　 Introduction to Industrial Technologies
[Instructor] Yun Lu
[Credits] 2
[Semester] Spring-Mon 5
[Course code] T1Z05400
[Room] Bldg.Eng17-111
[Candidate] Students of Faculty of Engineering, and other Faculties
[Teaching description] First, the course will discuss the development of global industrial technologies with focus on Japanese technologies, changes of people's lives caused by technologies, environment and energy situations, and the history, current situation and future of industrial technologies. The course will also provide lectures on the necessary mindset as industrial engineers, resource research, how to write technical papers, and how to give research presentation, as well as guidance on studying and report writing techniques for students majoring in science and engineering.
[Course objectives] The objective is to increase the understanding of foreign exchange student majoring in science and engineering towards the development of industrial technologies and changes of people's lives caused by technology development, environment and energy situations, and to teach students the basic abilities that are required as industrial engineers (mindset, resource research, how to write technical papers, and how to give research presentation, etc.) as well as guidance on studying and report writing techniques for students majoring in science and engineering. At the same time, the course is aimed to enable foreign exchange students to gain a better understanding on the industrial technologies of Japan and to acquire the ability to contribute to the development of industries and technologies in their home countries or to work in Japanese companies in the future.
[Plans and Contents] The lectures will be given in 2 parts. Part 1: History, current situation and future of industrial technologies (Classes 1 – 9), and Part 2: Path to becoming a researcher. To ensure a better understanding, lecture resumes will be distributed on the web and lectures will be given using a projector. Achievements will be evaluated by reports and presentation (Classes 10 – 15).

1. Orientation and discussion about course content
2. Advances in industrial technology worldwide
3. Advances in industrial technology in Japan
4. Unique industrial technology
5. Industrial technology and life
6. Industrial technology and energy, the environment
7. 21st century industrial technology
8. How to write a report
9. Assignment presentation 1
10. Basic R&D thinking 1
11. Basic R&D thinking 2
12. Resource research
13. How to write a technical paper
14. Research presentations
15. Research presentations 2
16. Research presentations 3

[Textbooks and Reference Books] Textbook is not specified. Handouts will be provided via http://apei.tu.chiba-u.jp/Luyun-HP.html. Reference books will be introduced in class time.
[Evaluation] Attendance（30%) and exercises, report (30%) and presentation (40%), the total score 60 accredited.
[Course requirements] Not particularly
[Remarks] Foreign students only, the choice subject (F30 or F36) and no credit for Japanese students（Z99）.

居住のデザインと生活技術　 Dwelling Design and　Living Technology

[Instructor] Yun Lu
[Credits] 2
[Semester] Fall-Fri 4
[Course code] T1Z055001
[Room] Bldg.Eng.17-213
[Course enrollment] about40
[Candidate] Students of Faculty of Engineering, Other Faculties, and Specially Registered Non-Degree Student.
[Teaching description] This course will be led by grand fellow Atsushi Maruyama.
[Course objectives] In the life of a person, there are various schemes being repeated in our given environment, the various designs that lead to scales of city or region from around us cannot be done elsewhere.　For foreign students aiming to go to form a professional environment, firstly, they need to focus on design and life skills for such residence, then think of the parallel development, also, in the present, they need to understand what is being deployed.
[Plans and Contents] We would like to discuss, in seminar format, examples of native students not only in the case in Japan, regarding the technology and lifestyle design for residential, and deepen the understanding. There are also plans of visits outside the university during the term.

1. October 3 – Orientation: What does “living” mean? How have people designed living spaces thus far?
2. October 10 – What types of houses can be found now in Japanese urban and rural areas?
3. October 17 – What types of houses can be found in Japanese historical rural and fishing areas?
4. October 19 (Sunday) – On-site observation: Boso Hudokinooka Open air Museum. (Bus tour)
5. October 24 – What types of houses can be found in Japanese historical urban areas?
6. November 7 – What trends have been seen in designing dining spaces kichen and family room?
7. November 14 – What trends have been seen in designing drawing rooms to allow for social relationships?
8. November 21 – What trends have been seen in designing amusement spaces for Noh and Kabuki?
9. November 28 – What trends have been seen in designing amusement spaces in Tokyo Disney land?
10. December 5 – How people have designed tea houses and Sukiya houses facing four seasons and nature?
11. December 12 – How people have designed tea gardens and imperial villa facing four seasons and nature?
12. December 19– How people designed religious spaces in dwelling houses and community during Bon and Shogatsu?
13. January 9 – How people designed religious spaces, Temples and Shrines in community?
14. January 23 – How people designed religious monument such as five storied pagodas ?
15. January 30 – Summary and Overall Discussion

[Keywords] Dwelling house, Design, Living Technology, Mealtime, Relationship, Religious Belief
[Textbooks and Refrence Books] Textbook is not specified. Reference books will be introduced with the process of class on appropriate time.
[Evaluation] Evaluation will be given by small questionnaire with attendance sheet, presentation of the report in seminars at each research room, and the final report.
[Course requirements]　Not particularly
[Remarks] Foreign students only, subject of choice（F30 or F36）and no credit for Japanese students（Z99）