電気電子工学セミナー　Seminar on Electrical and Electronics Engineering
[Instructor] Seiichi Koakutsu
[Credits] 2
[Semester] 1st year-Spring Mon 2
[Course code] T1R001001
[Room] Bldg.Eng 17-214
[Course enrollment] 80
[Course description] Students will be instructed how to manufacture an amplifier in the first part, and how to make a report and a presentation in the second part of the class
[Course objectives]
Labs and practice will give students more familiarity with and more interest in electrical and electronic engineering, and will provide them with goals.

	Targerts of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand electric electronic about perspective	1,2,5	Reports	10 %
2	Through the production of the speaker, understanding for how electromagnetism and a circuit theory are really helpful.	3～10	Reports	30 %
3	In production training,search things through the solution to problems or improvement of the performance logically and understand a route to embody the result.	3～10	Reports	30 %
4	I recognize the importance of transmitting the way of thinking in one's action that I went for and the background to others clearly and wear basics ability.	11～14	Presentation	30 %

[Plans and Contents]
1. Overall guidance for seminar on Electrical and Electronics Engineering
2. Lab Guidance
3. First lab (build a speaker)
4. Second lab (build a speaker)
5. Third lab (build a speaker)
6. Third lab (Build a speaker, build an amplifier)
7. Fifth lab (build an amplifier)
8. Sixth lab (build an amplifier)
9. Seventh lab (build an amplifier)
10. Eight lab (Regulate and improve speaker and amplifier)
11. Reports and presentation practice (Part 1)
12. Reports and presentation practice (Part 2)
13. Reports and presentation practice (Part 3)
14. Reports and presentation practice (Part 4)
15. Faculty introduction

[Evaluation]Evaluation will be taken based on attendance for both of lecture and Practical training. Moreover, Report writing and Presentations of score must be marked over 60point.

電磁気学 I および演習 Electromagnetic Theory I with Exercise
[Instructor] Tadanao Zanma
[Credits] 3
[Semester] 1st year-Fall Thu 1 / 1st year-Fall Fri 2
[Course code] T1R002001, T1R002002
[Room] Bldg.Eng. 15- 110
※Lecture will be offered on Thu 1 and Fri 2 in total 22times(Lecture 15times, seminar 7).
[Course enrollment] 140
[Course description]
Beginning with an introduction to vector calculus, lectures and practical drills will teach students about Coulomb's law, Gauss's law, electrostatic fields, electrostatic potential, the nature of conductors and dielectric bodies and the basic principles of currents and other electrical phenomena in electrostatic fields.
[Course objectives] For students in science and technology who have mastered calculus in high school, basic electromagnetism will be systematically learned centering the general phenomena relating to dielectric field in electromagnetism phenomena as a purpose. An achieving objective of a subject is as listed below.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand the basics of a vector analysis, Gauss's theorem, and Stokes' theorem	1, 2, 3, (Practice1)	Practice, final exam	5 %
2	To understand distribution of charges, Coulomb's law, and electric field and line of electric force	4, 5, (Practice2)	Practice, final exam	10 %
3	To understand Gauss's law	6, 7, (Practice3)	Practice, final exam	20 %
4	To understand electric field, and electric potential, electrostatic potential, a capacitor and capacitance	8, 9, (Practice4), 10, (Practice5)	Practice, final exam	25 %
5	To understand polarization, property of dielectric substance, basic principles and boundary conditions of the dielectric substance in the electrostatics field	11, 12, 13, (Practice 6)	Practice, final exam	25 %
6	To understand polarization, property of dielectric substance, basic principles and boundary conditions	14, 15, (Practice7)	Practice, final exam	15 %

[Plans and Contents] Lectures and exercises will be paired and the students will, as needed, answer exercise assignments on
1. what they learned in the lectures.
2. Scalar and vector functions; coordinate systems (Section 2.2-2.3)
3. Vector products, vector differentiation, line/area/volume integrals (Section 2.4-2.8)
4. Gradients, vector divergence and Gauss's law, vector curl and Stokes' theorem (Section 2.9-2.11)
5. Charge distribution, Coulomb's law (Section 3.1-3.2)
6. Principle of locality and electric fields, lines of force (Section 3.3-3.4)
7. Gauss's law (1) (Section 3.5)
8. Gauss's law (1) (Section 3.5)
9. Electric fields and potential, electrostatic potential (1) (Section 3.6)
10. Electric fields and potential, electrostatic potential (1) (Section 3.6)
11. Electrostatic energy, condensers and capacitance (Section 3.9-3.10)
12. Capacitance and permittivity, polarization and polarization vectors, polarization charge, and electric fields in condensers. (Section 4.1-4.3)
13. Basic laws of electrostatic fields in dielectric bodies (Section t 4.4)
14. Boundary condition (Section 4.6)
15. Steady-state current and conservation law (Section 6.1)
16. Ohm's law (Section 6.2-6.3)
17. The end of term exam: Comprehensive exam based on class content

[Keywords] Coulomb's law, electrical potential, electric field, Gauss's law, capacitor, dielectric, dielectric flux density, polarization, electrostatic energy, current

[Textbooks and Reference Books] Textbook: Denjikigaku, Uno et.al, CoronaSha, ISBN 978-4339008142, Study guide: Ace Denjikigaku, Sawa et.al, AsakuraShoten, ISBN 978-425422741, Recommended practice book: ShokaiDenjikigakuEnshu, Goto et.al, KyoritsuShuppan, ISBN 978-4320030220
[Evaluation] The students will be evaluated in submitting seven exercise assignments, and a term-end exam. The questions corresponding to the degree of attainment and the degree of difficulty as listed in the purpose and the objective of the subject will be on the term-end exam.
In order to obtain credits, both of the following (1) and (2) are required. (1) Students should submit all of seven exercise assignments on the designated date and at the designated location, and these assignments will be accordingly accepted.(aa2) Students should acquire points no lower than 60% at the term-end exam.
Students in other faculty in the own department, in other departments, and credited auditors may take this course.
[Related courses] Electromagnetic Theory II with Exercise (T1R004001), Electromagnetic Theory III with Exercise (T1R005001)
[Remarks] Electromagnetic Theory I with Exercise will follow, Electromagnetic Theory II with Exercise on next semester.

電磁気学 II および演習　Electromagnetic Theory II with Exercise
[Instructor] Saotome Hideo
[Credits] 3
[Semester] 2nd year-Spring Mon 1 / 2nd year-Spring Thu 1
[Course code] T1R004001, T1R004002
[Room] Bldg.Eng. 17- 213
※　Lecture will be offered on Mon 1 and Fri 2 in total 23times. And the allotment will be announced at the first class.
[Course enrollment] 100
[Candidate] Students in other faculty in the own department may take this course; including those in second grade, and transferred in the third grade of the electronics mechanical engineering, and those in the advanced science programs and other faculty permitted to take lecture
[Course description] General phenomena relating to dielectric wave and basic principles including current and magnetism, electromagnetic law, magnetism, electromagnetic waves, and Maxwell's equations; will be lectured.
It is a purpose for the students who have taken the course of the electromagnetism1 to learn basic electromagnetism systematically centering the general phenomena relating to electromagnetic waves and basic principles.
[Course objectives] Learning objectives are as follows: Learning objectives are as follows:
The electromagnetism is a subject to be positioned on a basis of the electric and electronic engineering department.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the phenomena and basic theory of electrical currents and magnetism	1-3	Final exam	30 %
2	Understand the laws that govern electromagnetic instruction	4-7	Final exam	30 %
3	Understand the properties of magnetic bodies	8-12	Final exam	20 %
4	Understand the fundamental meaning of Maxwell’s equations	13, 14	Final exam	20 %

[Plans and Contents] The lectures and exercises for the following descriptions will be split in 23 and provided. The lectures and exercises for the following descriptions will be split in 23 and provided.
A degree of mastering attainment will be evaluated with the term-end exam and homework reports.
1. Ampere’s circuital law
2. Magnetic field rotation
3. Magnetic potential, magnetic fields and solid angles
4. Biot-Savart law
5. Stokes’ theorem
6. Forces acting on currents
7. Magnetic circuits
8. Continuity of magnetic flux, magnetic field boundary conditions, and magnetic flux density
9. Vector potential
10. Magnetic energy
11. Forces acting on magnetic bodies
12. Inductance, flux linkage
13. Internal conductance in conductors
14. Mutual inductance
15. Magnetization properties of magnetic bodies
16. Magnetic moments, magnetic dipoles
17. Faraday’s law of induction
18. Current distribution in conductors, eddy currents, EM waves
19. Maxwell’s equations, displacement currents, EM radiation

[Keywords] Ampere’s circuital law magnetic field magnetic flux density,Biot-Savart law,Stokes’ theorem，magnetic circuit vector potential,inductance,magnetic moment magnetic dipole,Faraday’s law of electromagnetic induction，displacement current，Maxwell’s equations

[Textbooks and Reference Books]No text is designated, but students should choose a reference text to suit them.
[Evaluation] It will be evaluated by Practical Report (20%) and final exam. (80%).In order to obtain credits, students is required to gain over 60 points.
[Related courses] Electromagnetic Theory I, Electromagnetic Theory
[Course requirements] Students are required to have academic ability of earning the credit of Electromagnetic Theory I.

統計力学　Statistical Mechanics
[Instructor] (Toshiaki Saito)
[Credits] 2
[Semester] 2nd year-Spring Fri 1
[Course code] T1R006001
[Room] Bldg.Eng.17- 113
[Course enrollment]100
[Candidate]Students of faculty of Engineering; including those in second year, and transferred in the third year of the electronics mechanical engineering, and those in the advanced science programs and other faculty permitted to take lectures
[Course description] A basic description of the thermodynamics and statistical dynamics will be simply explained so that the students can understand within a range of general physics and calculus to be learned in the first grade. A basic concept will be emphasized so that the students will be able to further learn by themselves whenever need may arise in future.
[Course objectives] Students will learn basic concept necessary for handling thermal equilibrium out of the classical writings and the quantum statistical mechanics. A way of thinking in the statistical dynamics will be explained from the beginning point so that they will understand the
nature of the frame and master the applied skill as a keynote.

Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
Thermal concepts and thermodynamics 1－ learning the third law. Elec. (D-2)(D-3)	1-6	Final exam, report assignment	30 %
Learn fundamental principles of statistical mechanics and simple examples. Elec (D-2) (D-3)	7-11	Final exam, report assignment	60 %
Learn the basics of classical and quantum statistical mechanics.Elec(D-2) (D-3)	9, 12-15	Final exam	10 %

[Plans and Contents]

1. Statistical mechanics deal with the same macroscopic systems found in physical thermodynamics, but the approaches used are different. We show the relationship between macroscopic and microscopic states of thermal equilibrium with simple particle models, and introduce the rest of the course.
2. Thermodynamic principles – Based in the properties of thermodynamic equilibrium discussed in the previous class, this class we discuss the state equations, heat capacity, quasi-static processes and other fundamental thermal concepts.
3. The first law of thermodynamics – Discussion on the energy conversation laws which also cover heat energy. Also explain the concepts behind state quantities, total differentials, partial differentials, adiabatic change in ideal gases, and Joule's experiment.
4. The Second law of thermodynamics Ⅱ Discuss Kelvin's and Clausius' expression of the second law of thermodynamics, and show their equivalence using the Carnot cycle and Carnot's theorem. Will also discuss efficiency of heat engines.
5. The Second law of thermodynamics IIExplain thermodynamic absolute temperature and the Clausius inequality, introduce the concept of entropy as a quantity of state.
6. Thermodynamic potential and applications in thermodynamics – Show a variety of thermodynamic relationships, and explain Helmholtz and Gibbs free energies. Also discuss Maxwell's equations, the Joule-Thomson effect, and other thermal phenomena.
7. Principles of statistical mechanics I – Discuss the thinking behind statistical ensembles and basic probability concepts. Using statistical macrostate weighting, discuss equilibrium in isolated systems (microcanonical ensembles). Also introduce entropy from a statistical mechanics perspective.
8. Simple applications of microcanonical ensembles – Explain the Frenkel defect and 1D rubber model as examples of applications of microcanonical ensembles.
9. Principles of statistical mechanics II – Explanation of simple quantum mechanics principles and the concept of microscopic states (i.e. eigenstates). Through this, discuss heat equilibrium, and explain canonical ensembles and Boltzmann distributions.

10. Simple applications of canonical distributions I – Explain two-level systems (Schottky specific heat), harmonic oscillators, heat capacity in solids, and other concepts as applications.
11. Simple applications of canonical distributions II: relationship between canonical and microcanonical ensembles – Show how to solve the same sample problems (two-level systems and harmonic oscillators) using both canonical and microcanonical ensemble methods, and deepen student understanding of statistical mechanics.
12. Classical statistical mechanics – Using phase space, show how classical mechanics defines the microscopic state of a system. Use this to derive the principles of statistical mechanics, and discuss canonical and microcanonical ensembles from the perspective of classical statistical mechanics.
13. Applications of classical statistical mechanics – Discuss the principle of equipartition of energy and heat capacity through classical statistical mechanics. It will be also explained simple application problems.
14. Applications of classical statistical mechanics – Discuss the principle of equipartition of energy and heat capacity through classical statistical mechanics. It will be also explained simple application problems.
15. Introduction to quantum statistics
16. Exam

[Keywords] thermodynamics, statistical mechanics, entropy, classical statistics, quantum mechanical statistics
[Textbooks and Reference Books] No text is designated. Simple lecture notes will be distributed in class. Reference books are “Thermodynamics and statistical mechanics” by Toda :Iwanami, “Statistical mechanics” by Nagaoka :Iwanami, “Statistical Physics”: Berkeley Physics Course: Maruzen, “Statistical Physics I and II”: Manchester Physics Series: Kyoritsu, “Way of thinking of thermodynamics and statistical mechanics” by Sunagawa, and “Thremology” by Koide: Tokyo Univ.
[Evaluation] Students will be evaluated with a term-end exam (70%) and the relevant reports (30%).
A degree of attainment will be evaluated in a column Purpose and Objective as 1, a term-end exam (60%) and a report (30%) as 2, and a column 3 with a term-end exam (10%). Questions will be set based on a term-end exam and a report as 100 points in full marks of which 60 points are provided with a description and a degree of difficulty corresponding to a degree of attainment listed in the Purpose and the Objective of the subject. Students will need taking both a report and a term-end exam and the scores of both the report and the term-end exam will be no lower than 40 points in order to acquire a credit.
[Related courses] Thermodynamics Exercise in Thermodynamics、Statistical Mechanics、Quantum Mechanics
[Course requirements] This subject is a replacement subject of "Physics DI Introduction of thermal statistics dynamics" for students of the electric and electrical engineering course. Details relating to Electronics (D-2), (D-3) of "Specific attainment objective" related to electronics and electric based study and educational objective will be covered.

回路理論 I および演習　Electric Circuit Theory I with Exercise
[Instructor] Yukihiko Sato
[Credits] 4
[Semester] 2nd year-Spring Fri 3, 4
[Course code] T1R007001, T1R007002
[Room] Bldg.Eng- 17- 113
[Course enrollment] 90(As far as it is possible to contain the number of students, in the classroom, some extent is admitted.
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.; 2nd year of Department of Electrical and Electronics Engineering.
[Course description] The minimum required description about a direct current circuit and an alternative circuit will be lectured out of the basics of the circuit.　Students will be explained that they will be able to analyze an alternating current circuit using an impedance concept identical to a direct current circuit if they can understand the easiest direct current circuit.
[Course objectives] Students will learn about an electric circuit as basics of the system engineering, and the electric and electronics engineering such as a basic concept of an electric circuit, an expression method, an analysis method and a meaning of physical phenomena.　It is an objective that the students will take a course of the "Circuit Theory I Exercise" in a specialized subject concurrently with this subject to repeatedly solve practical questions, so that they will more understand the basic knowledge and master applied skills.
Students will first learn about basic knowledge including physical meanings of voltage, current, and electric power in a direct current circuit, direct current and parallel connections, Ohm's law, Kirchhoff's laws.
Then, they will learn definitions of the voltage, and current in an alternating current circuit, behaviors of impedance and a capacitor, a complex number expression of an alternating current circuit, and a three-phase alternating current by means of generalizing a resistance with an impedance concept.

	Targets of the subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand movement and behavior of circuit elements (Elec E-2)	2, 3, 11	Exam	20 %
2	Be able to use the circuit equations for DC circuits. Understand and be able to find solutions to the circuit equations. (Elec E-2)	1, 4, 5	Exam	25 %
3	Understand the basic theorems behind AC circuits, and easily handle circuit calculations. Also be able to do the Δ- transform and Y- transform (Elec E-2)	6, 7	Exam	15%
4	Understand how impedance principles allow AC circuits and DC resistance circuits to be calculated in the same way, and be able to calculate AC circuits (Elec E-2).	8, 9,12, 13, 14	Exam	20%
5	Understand that by treating resistance as complex impedance to handle AC circuits, phenomena that aren’t seen in DC resistance circuits can appear. (Elec E-2)	10, 11, 15	Exam	20 %

[Plans and Contents] The students will lastly learn about a four-terminal network as an introductory part of a transmission circuit.Circuit element and Ohm's law. Students will learn about definitions of the voltage and the current to understand the physical meanings. They will lean about behavior of the electric power and the resistance, and study the electric power which will be consumed in the resistance. They will further understand the behaviors of a capacitor and an inductance, and study energy which will be accumulated.Application of Kirchhoff's laws and Ohm's law; Students will learn about Kirchhoff's Current law andKirchhoff's voltage law which are extremely important in writing an equation of an electric circuit.

1. A circuit graph; A variable number is appropriately determined to write an equation to solve a simple circuit while it is important to determine variables systematically and write an equation in order to deal with a complex circuit. The students will this time study a nodal equation based on Kirchhoff's current law with a concept introduction as cut set from the graph theory.
2. Tree and co-tree in a graph; the students will, continuously at the last occasion, learn about a mesh equation and a closed circuit equation based on Kirchhoff's voltage law with a concept of a tree and a co-tree introduced from the graph theory.
3. Basic theorem in the electric circuit; this is extremely an effective means in a circuit analysis. The students will learn about the most important theorem in investigating a property of a circuit. They will also learn about Principle of superposition, which is important to a liner circuit, Thevenin's theorem, reciprocity theorem, and Tellegen's theorem, which is realized even in the liner and non-liner circuits.
4. Concept of Impedance; the students will understand that expressing a sine wave in a complex index function allows differential and integral calculus calculation to lead to an algebra calculation.Accordingly, they will learn that a steady-state analysis can be covered, using a concept of an impedance and an admittance, identical to a direct current current resistance circuit.
5. Symbolic method of an alternating current circuit; the students will study about a track drawn by a top of a vector, and vector track, based on a complex number expression including voltage, current and impedance on an assumption that these are vectors on a complex surface when frequency and a value in a circuit element is changed.
6. Duality of a circuit; a concept of correspondence relations such as current and voltage, resistance and conductance, and a parallel and a series is referred to as duality. The students will understand what it means by two circuits which are alternatively on a dual relation, and learn that a solution of an equation for circuits which are alternatively on a dual relation is also a solution of the other circuit. (Intermediate exam)
7. Power circuit; the students will learn about instantaneous power in a sine wave steady-state, average power, an effective value, and power factor. They will also learn how to calculate power from a complex number expression of the voltage and the current.
8. Resonance circuit; the students will learn that resonance, or antiresonance in which or voltage, current and a size of an impedance becomes peak or least in a certain frequency when a frequency is changed in a series circuit and a parallel circuit of RLCs, and they will understand that how the resonance is caused can be described with the fineness of the resonance and a half bandwidth.
9. The nature of the coupled circuit elements.4. Property of a connection circuit element; the students will understand how the mutual impedance having four terminals like a transformer works.
10. Three-phase alternating current; the students will learn how to display a relation between voltage and current on the Δ wire connection and Y wire connection in vector codes, and the entire power fluctuation becomes constant.
11. Distorted wave alternating current; the students will learn how to cover non-sine wave steady-state alternating current. They will understand that the current can be covered by superimposing sine waves with different frequencies because voltage and current periodically repeat time.
12. Four-terminal network (two-terminal pair circuit); When electric signals and power are transmitted, it will often cause a problem only in a relation between voltage and current at the sending side and the receiving side even with no knowledge on the contents of the circuit. Students will learn how to express voltage and current in a four-terminal network, concurrently understand a physical meaning of the parameter thereof.
13. Connection of four-terminal network; Students will learn how to express a new four-terminal network by connecting a plurality of four-terminal network in the original two-terminal pair circuit parameter
14. Final Exam

[Keywords] Resistance, Inductance, Capacitance, Electromotive force, Mesh, Branch, Direct Current, Alternating Current, Impedance, Resonant Circuit, Law of Superposition, Reciprocity Theorem

[Textbooks and Reference Books] Textbook :「Basics of Electrical Circuit」SONE Satoru, DAN Ryo, Reference book「Entry Level Electrical Circuit SAITO Osami, AMANUMA Katsuyuki, SAOTOME Hideo，「Basic Circuit Theory」Charles A. Desoer & Ernest S. Kuh（McGraw-Hill）

[Evaluation] Evaluated will be given by Exams. Students must obtain over the score of 60points.

[Related courses] Electromagnetic Theory, Electromagnetic Theory

[Course requirements] Have basic knowledge on calculating derivatives, integrals, trigonometric and complex functions, and matrices.

[Remarks]This course gives students basic knowledge and ability to apply it, and satisfied electrical and electronics course educational goal “(E) Mastering Specialized Knowledge”.

回路理論 II および演習　Electric Circuit Theory II with Exercise
[Instructor]Hashimoto Kenya
[Credits] 4
[Semester] 2nd year-Fall Fri 4, 5
[Course code]T1R008001,T1R008002
[Room] Bldg Eng.17- 112
[Course enrollment]About less than90
[Candidate] Students of Department of Electrical and Electronic Engineering, Transferred students, Students in other department in the own faculty, and Specially Registered Non-Degree Student may take this course.
[Course description] Lectures (fourth period in principle); Analysis of a transient response in a passive circuit composed of R, L, and C, and analysis of distributed element circuit represented by a coaxial line and parallel conductive lines will be lectured.　Exercise: this is a lecture related to descriptions of a lecture along the circuit theory II, and the students will submit prepared questions in a report from every week, and these will be explained at the time of exercise.
[Course objectives] As a lecture, students will understand a differential equation expressing time change of voltage and current (electric charges) in the circuit; the initial conditions thereof; and transient response of the voltage and the current obtained by those, the students will also become familiarized with the solution of a differential equation with the Laplace transform method. The lecture also introduces matrix representation of electric circuits with multiple terminals. They will also learn that voltage and current will be propagated as a wave motion, and basic issues relating to wave propagation to master an analysis method of the distributed element circuit. Finally, they will more recognize reflection and transmission of the voltage and current waves, and matching with a load to learn the meaning of the Smith chart, and how to use it. The exercises are not independent from the lectures, and aimed to have the students make a habit of thinking by themselves, understanding to go forward. Exercise questions every time are in principle those related to the description of the lectures until the last time

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to express circuit voltage/current (charge) when connecting a passive RLC circuit (also M) to a DC or AC voltage (or current) source, as functions of time with differential equations, and understand how to solve them. (E-2)	1, 2, 3, 8	Mid Term Exam	15 %
2	Solutions to the above differential equations are called general and special solutions in mathematics. Understand how these applicable to electronic circuits, and using previously gained knowledge of AC theory with the special solution, be able to easily describe the solution. (E-2)	1, 2, 3, 8	Mid Term Exam	10 %
3	Be able to show time variations of more complex circuits be able to explain it, and understand how it is applicable in actual electronic circuits including a alternate current voltage source. (E-2, H-3)	4, 5, 8	Mid Term Exam	10 %
4	Gain a rough understanding of Laplace transforms, and be able to apply them to actual transient response analysis.(E-2)	6, 7, 8	Mid Term Exam	15 %
5	Study how to analyze behavior of electric circuits with multiple terminals by the use of the matrix operation.	8, 9, 15	Final Exam	10 %
6	Understand that voltage and current are propagated as waves in distributed element circuits, and be able to explain general wave behavior. (E-2, H-3)	10, 11, 12, 15	Final Exam	15 %
7	Understand wave reflectance and transmission that is produced at connecting points of different lines (boundaries), and be able to explain. (E-2)	10, 11, 12, 15	Final Exam	15 %
8	Understand the principles of the Smith chart, and be able to apply it to actual distributed element circuits. (E-2, H-3)	13, 14, 15	Final Exam	10 %

[Plans and Contents]

1. Transient response in basic circuits 1 – Students will learn the importance of transient response in electronic circuits through explanation on how when RL or RC circuits are supplied with a DC voltage, circuit voltage/current can be expressed as functions of time with differential equations and their initial conditions; general and special solutions to differential equations are related to transient and steady-state solutions in electronic circuits; and how voltage and current behavior (transient response) can be taken as functions of time, and EM energy and electro-static energy that accumulates in circuits. In particular, students will learn that is is more important to treat the electric charge that accumulates in the capacitor (or the voltage between the capacitor terminals) as unknown in circuits with capacitors than to treat the current as unknown. Drill 1 – Practice problems from first Circuit Theory II lecture.
2. Transient response in basic circuits 2 – Review how to express circuit voltage and current (charge) with differential equations when a direct current is supplied to an RLC circuit. Continue to look at circuit voltage and current transient response, and understand the relationship between the electromagnetic and electrostatic energies that accumulate in the inductor and capacitor. Drill 2 – Practice problems from second Circuit Theory II lecture.
3. Transient response in basic circuits 3 – Finding the steady-state solution (the special solution) for RLC circuits when a time-variant voltage such as triangular and rectangular signals are applied, and learn about transient voltage and current response for this case. Drill 3 – Practice problems from third Circuit Theory II lecture.
4. Transient response in basic circuits 4 – Finding the steady-state solution (the special solution) for RLC circuits when an AC voltage is applied, and learn about transient voltage and current response. Drill 4 – Practice problems from fourth Circuit Theory II lecture.
5. Laplace transform definition and laws – Give an overview of the Laplace transform, which is necessary part of solving the differential equations encountered in classes 1-4, and explain the related laws. Will also teach students how to simply do Laplace transforms on the exponential and trigonometric functions often used in electronic circuit theory. Drill 5 – Practice problems from fifth Circuit Theory II lecture.
6. Differential equation solutions using the Laplace transform – Explain the algebraic partial fraction expansion useful when solving inverse Laplace transforms, and how by using this and the laws discussed in class 5, special complex integration is unnecessary to find simple solutions to the differential equations used to find transient response in the electronic circuits covered this lecture. Drill 6 – Practice problems from sixth Circuit Theory II lecture.
7. Transient response analysis using Laplace transforms – Based on the material from classes five and six, explain how to simply conduct transient response analysis on the problems within the scope of the first four classes. In particular, show how it is applicable to (non-general) solutions in which the boundary conditions are somewhat difficult to determine. Drill 7 – Practice problems from seventh Circuit Theory II lecture.
8. Mid Term Exam and Supplement 1 – Discuss the lecture supplement for classes 1-7, and problems with atypical boundary conditions. Drill 8 – Practice problems from Fifth～Sixth Circuit Theory II lecture. Examination on what was learned in classes 1-7.
9. Multi-Terminal Circuit – Study how to analyze behavior of electric circuits with multiple terminals by the use of the matrix operation. Drill 9 – Practice problems from ninth Circuit Theory II lecture.
10. Distributed element circuit analysis 1 – Derive the telegrapher equations that express voltage and current in coaxial lines, parallel conducting lines and other typical distributed element circuits, and by solving them, learn how voltage and current are propagated as waves in lines, and understand the fundamental points of wave behavior. Will also discuss the characteristic impedance. Drill 10 – Practice problems from Tenth Circuit Theory II lecture.
11. Distributed element circuit analysis 1 – Derive the telegrapher equations that express voltage and current in coaxial lines, parallel conducting lines and other typical distributed element circuits, and by solving them, learn how voltage and current are propagated as waves in lines, and understand the fundamental points of wave behavior. Will also discuss the complex propagation constant in lines and characteristic impedance, and at the same time, see how the phase constant and characteristic impedance in coaxial liens and parallel conducting lines can be expressed depending on physical structure and material. Drill 11 – Practice problems from eleven lecture.
12. Distributed element circuit analysis 2 – Through choosing appropriate boundary conditions for voltage and current in a line, understand how they can be expressed as a function of position. Will also look at how voltage and current propagated as waves reflect/transmit at connections between different lines. Drill 12 – Practice problems from twelfth Circuit Theory II lecture.
13. Distributed element circuit analysis 3 – Show how the reflection coefficient in a line can be shown simply by using the reflection coefficient at the load end when assuming that a load is connected to one end of a line. Through this, understand how to express voltage and current distribution in the line. From these results, explain standing waves within circuits. Drill 13 – Practice problems from thirteenth Circuit Theory II lecture.
14. Distributed element circuit analysis 4 – Show how the reflection coefficient in a line can be shown simply by using the reflection coefficient at the load end when assuming that a load is connected to one end of a line. Through this,

understand how to express voltage and current distribution in the line. From these results, explain standing waves within circuits. Drill 14 – Practice problems from fourteenth Circuit Theory II lecture.

15. Distributed element circuit analysis 5 – Using Smith charts, learn how to find line impedance, reflection coefficient, load, etc. Drill 15 – Practice problems from fifteenth Circuit Theory II lecture.
16. The end of term exam – Examination on what was learned in classes 9-15.

[Keywords] Lumped Element Circuit, Transient Response, Laplace Transform, Distributed Element Circuit

[Evaluation] Students must receive an overall mark higher than 60% on the mid-term and final examinations and in-class quizzes in order to earn credit

応用数学　Applied Mathematics
[Instructor] Tomoyoshi Ito
[Credits] 2
[Semester]2nd year-Fall Tue 3
[Course code] T1R009001
[Room] Bldg Eng.17- 113
[Course enrollment]Max 80
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.; 2nd year of Department of Electrical and Electronics Engineering, 3rd and 4th students of Department of Electronics and Mechanical Engineering and those in the advanced science programs and other faculty permitted to take lectures.
[Course description] Mainly from an applied mathematics used in the electric and electronic engineering, a vector analysis required as a basic knowledge when understanding electromagnetic field phenomena, and Fourier series expansion which are basics when handling distorted wave of a circuit phenomena will be explained.
[Course objectives] It is a purpose that students will master mathematical handling of a circuit phenomena with the vector analyses and Fourier series expansion, and electromagnetic phenomena

	Targets of the subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	1. Students will learn solutions of basic ordinary differential equations appeared in the electromagnetism and circuit phenomena.	1, 2, 3, 4, 5	Problem sets, report	30 %
2	2. Students will understand the concept including divergence and rotation, so that they will be able to use theorem relating to an integral of a vector.	6, 7, 8, 9, 10	Problem sets, report	35 %
3	3.Students will master Fourier series expansion and the development technology	11, 12, 13, 14, 15	Problem sets, report	35 %

[Plans and Contents] Fourier series expansions 1 -3, harmonics, complex Fourier series expansions and Fourier transforms, mid-term exam, mid-term exam solution check, vector analysis 1- 6, final exam, final exam solution check.

1. Ordinary differential equations 1- first order ordinary differential equations
2. Ordinary differential equations 2 - second order ordinary differential equations
3. Ordinary differential equations 3- second-order linear differential equations
4. Ordinary differential equations 4- applications in electromagnetism and electronic circuits
5. Ordinary differential equations 5- summary and direction for future development
6. Vector analysis 1 - vector operators
7. Vector analysis 2- Gradient, divergence, rotation
8. Vector analysis 3- Gauss' theorem
9. Vector analysis 4- Stokes' theorem
10. Vector analysis 5 - summary and direction for future development
11. Fourier analysis 1 - Fourier series
12. Fourier analysis 2 - Fourier integrals
13. Fourier analysis 3 - delta function
14. Fourier analysis 4 - applications in electromagnetism and electronic circuits
15. Fourier analysis 5 - summary and direction for future development

[Keywords] Ordinary differential equation, Vector analysis, Fourier analysis
[Textbooks and Reference Books] Wadachi Miki, "Butsuri no tameno sugaku (Mathematics for Physics)," Iwanami shoten.
[Evaluation] Students will be evaluated as laid out in Purposes and Objectives. Students must receive an overall mark higher than 60% on problem sets and reports to pass the course.
[Related courses] Electromagnetic Theory, Electric Circuit

確率基礎論 A Basic Course in Probability Theory
[Instructor] Takashi Okamoto
[Credits] 2
[Semester] 2nd year-Spring Wed 4
[Course code] T1R010001
[Room]Bldg. Eng. 17-113
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student..
[Course description] The class will cover basic issues related to probability. Starting from a probability space, the instructor will show all probability properties can be derived from two principles. Students will learn basic issues including the law of all probabilities, Bayes' theorem, random variables, various probability distributions, expected values and variance, the law of large numbers, and the central limit theorem. An introduction to stochastic process will be also explained.
[Course objectives] Students will master basics and essence of the probability theory. They will be able to comprehend adequately various probability issues and properties in order to apply them correctly.

	Target of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To master roles and importance of the probability theory in science and engineering (D-1)	1	Final Exam	5 %
2	To understand necessity of the probabilistic representation and meaning of basic properties of the probability, and acquire its notion (D-3)	2, 3, 8, 9	Final Exam	30 %
3	To understand meaning of random variables, and master how to use them (D-3)	4, 7, 10	Final Exam	20 %
4	To understand various probability distributions, and actually apply them (D-3)	5, 6,	Final Exam	15 %
5	To understand basic and important theorem in the probability theory (D-3)	11, 12	Final Exam	15 %
6	To understand Markov chain, and actually apply it (D-1)	13, 14	Final Exam	15 %

[Plans and Contents] Instructor lectures in accordance with the following plans. Students at the class are required to prepare materials that can be downloaded from the Chiba University moodle system before lecture.
1. Introduction
2. Probability space
3. Conditional probability and Bayes' theorem
4. Random variables and probability density function
5. Discrete probability distribution
6. Continuous probability distribution
7. Random variable functions
8. Random variable vectors and distribution
9. Expected value and variance
10. Generating function
11. Law of large numbers
12. Central limit theorem
13. Introduction of the stochastic process
14. Markov chains
15. Summary and assessment of understanding
16. Exam

[Keywords] Probability Space, Random Variable Probability Distribution Law of Large Numbers, Markov Chains
[Textbooks and Reference Books] Hirohisa Hatori: Atarashii Kakuritsu Nyumon, Makino Shoten (Textbook)
[Evaluation] Understanding degree will be checked by examinations.
[Course requirements] Not Particularly
[Related subject] Information Theory, Recitation Course for Calculus B2, Linear Algebra B2
[Remarks] Students who will take course of Information Theory in their 3rd year are recommended to take this course in their 2nd year.

数値計算　Numerical Computation
[Instructor] (Atsushi Shiraki)
[Credits] 2
[Semester] 3rd year-Spring Fri 1
[Course code] T1R011001
[Room] Bldg.GNE-A3F Information Processing study hall
[Course enrollment] About 100 （The number of Computers in the Lecture room）
[Course description] A numerical calculation method of mathematical formula appeared in the field of algebra and an elementary analysis will be described. If students solve these mathematical formulas with manual calculation according to the mathematical formula to obtain specific numeral values, it will be enormous amounts of calculation and often become unworkable. Therefore, the students will obtain the numerical values by processing the enormous amounts of calculation with a computer. Furthermore, calculation methods more effective and faster than using mathematical formulas as they are have been long formulated. Thus, the students will be explained a new calculation method fit for a computer in addition to the classical calculation method, and they will execute processing with a computer.
[Course objectives] It is a purpose that the students will understand a classical calculation method in algebra and elementary analysis, and a new calculation method fit for a computer. It is also a purpose that the students will process these with a computer to master basic knowledge and technology on the numerical value analysis.
[Plans and Contents]
1. Values, errors
2. Non-linear equations
3. Numerical integration methods
4. Accelerating numerical integration
5. Ordinary differential equations and initial-value problems
6. Finite difference method (FDM)
7. Finite element method (FEM)
8. Partial differential equations
9. FEM 2
10. Simultaneous linear equations – iterative solutions
11. Conjugate gradient (CG) method
12. Preconditioned conjugate gradient (PCG) method
13. Incomplete Cholesky conjugate gradient method
14. Eigenvalue problems
15. Matrix condition numbers

[Keywords] Numerical computation, differential calculus integral calculus, differential equations, linear algebra
[Evaluation] Based upon reports on problems presented in-class.
[Course requirements] Students have preferably taken courses of Information Processing.

電気電子計測 Electronic Measurements
[Instructor] Tadanao Zanma
[Credits] 2
[Semester] 2nd year- Fall Wed 2
[Course code] T1R012001
[Room] Bldg.Eng- 17- 113
[Course enrollment] 90
[Course description] Students will be explained about principles and technologies for measurement of the relevant physical amounts in electricity and electronics.
[Course objectives] It will be explained in the following target.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand basic principles of electronic measurement and statistical processing of measured values.	1, 2, 3	Interim exam	15 %
2	Understand the mechanisms of indicating instruments (ammeters, voltmeters, power meters)	4,	Interim exam	5 %
3	Understand measurement of direct and alternating currents – have a concrete understanding of four-point terminal method, bridges, effective value, grounding resistance, etc.	5, 6	Interim exam	15 %
4	Understand simple op-amp circuits –in particular low-pass filters, etc.	7	Interim exam	15 %
5	Understand digital measurement and conversion, sampling, quantization, and sampling theory.	9, 10, 11	Final exam	15 %
6	Understand Fourier spectra, power spectra, noise, signal-to-noise ratio	12, 13	Final exam	15 %
7	Understand resonance and the Q factor.	14	Final exam	10 %
8	Understand distributed parameter circuits, reflection, and impedance matching.	15	Final exam	10 %

[Plans and Contents] First, basic principles of the electronic measurement and basics of the measurement values for the objects to be measured will be explained. Then, an error theory will be described to explain principles and technologies of the electric and electronic measurement. Handling digital signals and resonance will be also explained

1. Fundamental measurement concepts (Text – Chap. 1)
2. Statistical behavior and processing I (Text – Chap. 2)
3. Statistical behavior and processing II, and digital expressions (Text – Chap. 2 and parts of Chap. 3)
4. Indicating instruments(Text – Chap. 4)
5. Measuring direct current with indicating instruments(Text – Chap. 5)
6. Measuring alternating current with indicating instruments(Text – Chap. 6)
7. Electronic devices and functional circuits used in measurement(Text – Chap. 7)
8. Mid-term exam
9. Digital measurement I(Text – Chap. 8)
10. Digital measurement II(Text – Chap. 8)
11. Waveform observation (Text – Chap. 9）
12. Measuring frequency and phase(Text – Chap. 10)
13. Noise (Text – Chap. 11)
14. Resonance and the Q factor(Text – Chap. 12）

15. Transmission line and impedance matching (Text - Chap.13)
16. Final exam

[Keywords] Theory of errors, Statistics and Probability, Validation, Bridge circuit, Operational amplifier, AD/DA conversion, Sampling theorem, Fourier transform, Resonance, Distributed element line

[Textbooks and Reference Books] DenkiDenshiKeisoku, Surikougakusha(Science sha), ISBN4-901683-09-8

[Evaluation] Evaluation is based upon the mid-term exam, final exams, and reports. To earn credit in the course, students must take both the mid-term exam (worth 40% of final mark) and the final exam (worth 40% of final mark), and receive an overall grade of over 60% after including the report mark (20% of final mark). Grade ranking is as follows: Superior – 90%+; Excellent – 80%-90%; Good – 70%-80%; Sufficient – 60%-70%. Fail – fewer than 60%.

[Related courses] Electromagnetic Theory Ⅰwith Exercise (T1R002001),Electromagnetic Theory II with Exercise (T1R004001),Electromagnetic Theory III with Exercise (T1R005001),Electric Circuit Theory Ⅰwith Exercise (T1R007001), Electric Circuit Theory II with Exercise (T1R008001), A Basic Course in Probability Theory (T1R010001)

[Course requirements] Students have preferably taken courses of Electromagnetic Theory I with Exercise (T1R002001) , Electromagnetic Theory II with Exercise (T1R004001) , Electric Circuit Theory I with Exercise (T1R007001) , A Basic Course in Probability Theory (T1R01000)

電気電子工学実験 I　Experiment of Electrical and Electronics Engineering I
[Instructor] Kenichiro Kondo
[Credits] 2.
[Semester] 2nd year-Fall Tue 4, 5
[Course code] T1R013001, T1R013002
[Room]: Bldg.Eng.17-113, Laboratory in Department of Electrical and Electronics Engineering,
[Course enrollment] 80
[Candidate] Specially Registered Non-Degree Student; All Department of Electrical and Electronics Engineering students
[Course description] Students will themselves use measurement devices to implement given experimental assignments, so that they will more understand circumstances related to electricity and electronics, and master characteristics of the measurement devices related to electricity and electronics and method of using these devices.
[Course objectives] It is a purpose that students will create a method for rating comprehending basic principles of the various phenomena, penetrating capability of quantitatively evaluating them, and an availability of these phenomena, and expanding compositional capability of substantiating a method for achieving a desired purpose.

	Targets of the　Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand characteristics of measuring instruments and how to use them.	Every week	Attitude towards experiments, reports	25 %
2	Gain quantitative experience through use of actual equipment.	Ever yweek except first week	Attitude towards experiments, reports	25 %
3	Create a brief outline report and learn how to make an organized report.	Every week	reports	25 %
4	Practice cooperation through working in a group, and learn how group discussion can lead to resolution and realization of issues that can’t be solved alone.	4-14	Attitude towards experiments	25 %

[Plans and Contents]All students will follow the same schedule until the third class. Student schedules will alternate beginning the fourth class, so will not follow this schedule.
1. Technical writing
2. Preliminary experiments – measuring combined resistance and writing reports
3. Preliminary experiments – electronic indicating meters (voltmeters and ammeters)
4. Measuring AC voltage, current and power (2 weeks)
5. Oscilloscope basics
6. Measurement with a DC potentiometer
7. 2 the terminal vs. circuit Part 1：2 Parameter measurement of the terminal vs. the circuit
8. 2 the terminal vs. circuit Part 2 – Basic characteristics of RC circuits
9. Resistive measurement (2-point and 4-point)
10. Measuring ground resistance Power circuits
11. Power circuits (2 weeks)
12. Hall devices
13. A-D conversions/ D-A conversion

[Keywords] An error, precision and accuracy, waveform measurement, an electric current and voltage measurement, power measurement, the electrical resistance measurement
[Evaluation] Students will be collectively evaluated according to an attitude to an experiment and a report.　Since the experiments of each assignment are closed when experiment reports are submitted, an evaluation of learning result for each experiment assignment will not be done unless an experiment report is submitted
[Related courses] Electronic Measurements
[Course requirements] Students are required the knowledge of Electromagnetic Theory and Electric Circuit Theory.
[Remarks] As there is only a limited amount of time for students to use the instruments, please read the experiment guidance sheet and prepare before coming to each class. This course satisfies electrical and electronics course goal (A) Communication Skills, (B) Practical Skills, (C) Event Observation and Discussion Skills, and (F) Problem Resolution and Implementation Skills.

最適化理論 Optimization Theory
[Instructor] Seiichi Koakutsu
[Credits] 2
[Semester] 2nd year- Fall Mon 2
[Course code] T1R014001
[Room] Bldg.Eng.17-112
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Students will be lectured about a role of optimization in the engineering. From basic knowledge on the optimization to topics on advanced technology will be easily explained.
To be more specific, the optimization such as linear programming, and non-linear programming, or basic methods in various types used in the field called a mathematical programming will be lectured.
Those in which elements having independent functions are binded in order to achieve a purpose, and each of these elements is operated in the order for achieving the purpose are referred to as a system. Electric appliances computers, telecommunications and transportation networks can be all deemed as a system. It is a technology which can be said to be indispensable in analyzing behaviors of the system mathematically to optimize designing the system to operate.
[Course objectives] In this lecture, students will understand basic theory of the system analysis, and optimization. If students take this course, they will be able to solve the question of the linear programming by a simplex method; verify the optimization in a solution in the non-linear programming; and solve the question of the non-linear programming by a descent method. In addition, the students will be able to explain a calculation principle of the basic optimization method.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to explain the basic thinking behind system optimization.	1, 2	The end of term exam	10 %
2	Be able to find solutions to linear programming problems using the simplex method.	3, 4, 5, 6, 7	The end of term exam	40 %
3	Be able to explain optimality conditions for solutions to non-linear programming problems.	8, 9,10, 11, 12	The end of term exam	30 %
4	Be able to find solutions to non-linear programming problems with the descent method.	13, 14	The end of term exam	20 %

[Plans and Contents]
1. Outline of the optimization theory: Basic concept of the optimization theory and its roles in the engineering will be explained. Required preparation study: Read chapter one in the text book.
2. Mathematical basics: Solution methods of matrix, rank numbers, and systems of equations as mathematical basics of the optimization theory will be reviewed. Required preparation study: Read chapter two in the text book.
3. Formulation of linear programming problems: The formulation of the linear problems with specific examples mentioned will be explained. Transformation into a standard form will be also described. Required preparation study: Read chapters 3.1, and 3.2 in the text book.
4. Basic solution and optimal solution: The basic solution and optimal solution of the linear programming problems will be explained. Conditions of optimization will be also described. Required preparation study: Read chapters 3.3.1, and 3.3.2 in the text book.
5. Simplex Method: The simplex method, which is a typical solution method of the linear programming problems, will be explained. Especially basic issues including basic transformation, simplex tablau and pivot operation will be described. Required preparation study: Read chapters 3.3.3, and 3.3.7 in the text book.
6. Calculation examples of Simplex method: The production planning problem for example and exact arithmetic procedures of Simplex method will be explained. Required preparation study: Read chapters 3.3.8, and 3.3.9 in the text book.
7. Two-phase Simplex method: The two-phase Simplex method with specific examples mentioned will be explained. Required preparation study: Read chapters 3.3.10, and 3.3.9 in the text book.
8. Formulation of non-linear programming problems: The non-linear programming problems will be formulated, and local optimal solutions and global optimal solutions will be explained. Concept of convex functions will be also described. Required preparation study: Read chapters 6.1 in the text book.

9. Optimality conditions of the unlimited problems: The optimality conditions of the unconstraint non-linear programming problems will be explained. Required preparation study: Read chapters 6.2.1 in the text book.
10. Optimality conditions of the problems with linear constraint: The optimality conditions of the non-linear programming problems with linear constraint will be explained. Required preparation study: Read chapters 6.2.2 in the text book.
11. Optimality conditions of the problems with non-linear constraint: The optimality conditions of the non-linear programming problems with non-linear constraint will be explained. Required preparation study: Read chapters 6.2.3 in the text book.
12. Calculation example of the optimality conditions: Specific calculation examples for the optimality conditions of the non-linear programming problems will be indicated. Required preparation study: Read chapters 6.2 in the text book.
13. How to obtain the optimal solution of the non-linear programming problems 1: A concept of a descent method as a solution method of the non-linear programming problems will be explained. Required preparation study: Read chapters 6.3.1, to 6.3.5 in the text book.
14. Calculation examples of the non-linear programming problems: Specific calculation examples of how to obtain the optimality conditions of the non-linear programming problems will be indicated. Required preparation study: Read chapters 6.3.6 in the text book.
15. How to obtain the optimal solution of the non-linear programming problems 2: The concept of Newton's method as a solution method of the non-linear programming problems, and indicate specific calculation examples will be explained. Required preparation study: Ro read chapters 6.3.7, and 6.3.8 in the text book.
16. End-term exam

[Keywords] linear programming problem, Simplex method, non-linear programming problem, optimality condition, decent method

[Textbooks and Reference Books] ``Mathematical Methodologies for Systems Engineering,'' Koichi NARA and Taiji SATO, Corona Publishing co. ltd, 1996

[Evaluation] Students must obtain over 60points in final exam to obtain the credit.

[Related courses] Information Processing, Information Theory Programming I・II, Numerical Computation

[Remarks] This course satisfies the Department of Electrical and Electronics Engineering learning and education goal "(H) Determination and Self-learning Skills."

電気エネルギー変換機器 Electric Machinery
[Instructor]Keiichiro Kondo
[Credits] 2
[Semester] 2nd year-Fall Fri 2
[Course code] T1R015001
[Room] Bldg.Eng. 17-214
[Course enrollment]90
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.; 2nd year of Department of Electrical and Electronics Engineering, students in advanced science programs and other faculties, students registered at Chiba Institute of Technology.
[Course description] Procedures of indicating operating principles and features of the electric equipment's, basic characteristics, and the properties quantatively will be explained easily based on the preparation.
[Course objectives]This class will teach students about electrical equipment, which serves as one part of electrical and electronics engineering, and give them the necessary knowledge and experience of electrical equipment they need as electrical and electronics engineers. The lectures will teach students how to understand the characteristics of electrical insulating transformers which control AC power conversion, electric motors that convert electrical energy to mechanical energy, and the basic characteristics of power generators.Will also learn about DC machines, induction machines and synchronous machines as examples of rotating machinery.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand and explain transformer principles and characteristics, and quantitatively explain properties.	1,2,3,4	Exam /Report	25 %
2	Principles of DC machines Understand and explain transformer principles and characteristics, and quantitatively explain properties.	1,5,6,7	Exam /Report	25 %
3	principles of induction machines Understand and explain transformer principles and characteristics, and quantitatively explain properties.	1,9,10,11	Exam /Report	25 %
4	principles of synchronous machines Understand and explain transformer principles and characteristics, and quantitatively explain properties.	11,12,13, 14,15	Exam /Report	25 %

[Plans and Contents] A lecture will be preceded according to the descriptions the orders as mentioned below to achieve the aforementioned objective. The description of the lecture might be modified and revised appropriately depending on the degree of understanding and others.Before the lecture, students should prepare the relevant sections in the text book and the materials to be distributed in advance.

1. Students will understand overall image about outline and principles of the electric equipments.
2. Impedance of a transformer and equivalent circuit: Students will comprehend magnetic flux occurred inside the transformer from the electric magnetic view, and logically understand the principles of the transformer. The students will also learn a method of expressing the characteristics electromagnetically lead in an equivalent circuit as impedance.
3. Loss of a transformer, and a test method: Students will learn about a type of loss occurred in the actual transformer, characteristics and efficiency. The students will be explained about a method for calculating constant numbers for an equivalent circuit of the actual transformer.
4. Ideal transformer: Students will know of the difference between an actual transformer and an ideal transformer to understand deeply electromagnetic phenomena of transformer. Engineering advantages of an ideal transformer will be also explained.
5. Category by operating principle of a direct current machine and an excitation method: Students will understand the basic principle of the direct current machine, and they will learn categories of excitation to others and a self-excitation (partial, direct, and multiple windings) by the excitation method.
6. Excitation method of a direct current machine and characteristics: Students will learn characteristics of each method including the excitation to others and a self-excitation (partial, direct, and multiple windings) of the direct current machine by a method of inducting from an equivalent circuit, and they will understand the characteristics.

7. Loss of a direct current machine, and efficiency: Students will learn the definition about a loss of a direct current machine and efficiency.
8. Middle Exam: Students will quantify mastering and achieving degree concerning the transformer and the direct current electric motor by a test.
9. Principle of an induction machine and an equivalent circuit: Students will learn physical meaning of an equivalent circuit with the similarity between the operating principle of an induction electric motor and a transformer.
10. Test method of an induction machine: Students will study about a test method for determining a constant on the equivalent circuit of the induction electric motor, and they will know a theory of determining these.
11. Characteristics formula of an induction machine and a control method: Students will study how to obtain a characteristics formula such as torque for an induction machine and output from a relation between input and output in an equivalent circuit; and they will know the characteristics. The students will also learn, using a characteristics formula, a proportion transit control of an induction machine, and a V/f control method using an inverter.
12. Principles of synchrous machine: Students will learn physical meaning of the equivalent circuit obtained from the operating principles of the equivalent circuit and a voltage variable rate synchronous electric motor, and magnetic characteristics, and they will study voltage variation ratio using these machine.
13. Input and Output of the synchronous machine: Students will learn how to induct relation between input and output of the synchronous machine from the equivalent circuit constant.
14. Vector diagram and circle diagram of the synchronous machine: Students will learn how to induct a vector diagram from the equivalent circuit and a circle diagram in which the vector diagram is illustrated, and the physical meaning.
15. Test method of the synchronous machine and the stability: Students will learn about how to determine the equivalent circuit constant of the synchronous machine and the stability of the synchronous machine.
16. End-term exam: Students will quantify the mastering and achieving degree related to the induction machine and the synchronous machine by a test.

[Keywords] Transformer, induction machine, synchronous machine, direct current machine

[Evaluation]Students are planned to be evaluated based on the mid-term exam (50% of final mark) and the final exam (50% of final mark), but reports and other methods may be added.

[Related courses] Electromagnetic Theory Ⅰ-Ⅲ,Electromagnetic Theory with Exercise Ⅰ-Ⅲ, Electromagnetic Theory I～II, Electromagnetic Theory with Exercise Ⅰ-Ⅱ, Electrical Systems, Electromagnetism, Power Electronics, Power Conversion Systems

[Remarks] This course is a replacement class for “Energy Conversion Devices.”

量子力学　Quantum Mechanics
[Instructor] Morita Ken
[Credits] 2
[Semester] 2nd year-Fall Mon 1
[Course code] T1R018001
[Room] Bldg.Eng.17- 213
[Course enrollment] 100
[Candidate] Students of faculty of Engineering
[Course description] Quantum dynamics is an extremely basic subject which is indispensable to understand operating principles of a nano-structured semiconductor device. In this lecture, students will learn basic concepts such as particles and wave nature, and uncertainty principles; and basic expression method such as Schrodinger equation; Hamiltonian matrix; and wave function, next they will be provided with easy example questions such as understanding a structure of atoms, energy of particles in a well-type potential which is indispensable for handling a nano device, and a potential barrier penetration probability. Explained while taking the actual device operation example in lecture
[Course objectives] Quantum dynamics is an extremely basic subject which is indispensable to understand operating principles of a nano-structured semiconductor device. In this lecture, students will master basic concept of the quantum dynamics, to be able to understand a structure of atoms. It is also an objective that the students will be able to solve easy example questions such as energy of particles in a well-type potential which is often used in a nano device, and potential barrier penetration probability

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the basic concepts of quantum mechanics: wave and particle nature, the uncertainty principle.	1, 2, 7	Assignment・Practice・Final exam	20 %
2	Understand the interference effect quantum mechanically	2, 3	Assignment・Practice・Final exam	10 %
3	Understand the Schrödinger equation	6, 7, 8, 9	Assignment・Practice・Final exam	20 %
4	Understand the tunneling effect	6, 9	Assignment・Practice・Final exam	10 %
5	Understand quantum well energy structure	7, 15	Assignment・Practice・Final exam	15 %
6	Understand the structure of the hydrogen atom	10, 11	Assignment・Practice・Final exam	10 %
7	Understand state transition probabilities	4, 5, 14	Assignment・Practice・Final exam	10 %
8	Understand devices that use quantum effects	15	Practice・Final exam	5 %

[Plans and Contents] Quantum dynamics is an extremely basic subject which is indispensable to understand operating principles of a nano-structured semiconductor device.
In this lecture, students will learn basic concepts such as particles and wave nature, and uncertainty principles; and basic expression method such as Schrodinger equation; Hamiltonian matrix; and wave function, next they will be provided with easy example questions such as understanding a structure of atoms, energy of particles in a well-type potential which is indispensable for handling a nano device, and a potential barrier penetration probability. Explained while taking the actual device operation example in lecture. They will also have to submit a report explaining key words every lecture.
1. Characteristics of Quantum Mechanics: wave and particle nature, uncertainty principle
2. States of matter/energy existence probability/probability amplitude
3. Identical particles: fermions and bosons
4. The Hamiltonian
5. Two-state transitions 1

6. Schrödinger equation/wave functions
7. Energy wave functions of a particle trapped in a potential wells
8. Drills
9. Potential barrier tunneling phenomena
10. Hydrogen atom model, from the hydrogen atom model to the multi-electron atom
11. Hydrogen atom model, from the hydrogen atom model to the multi-electron atom
12. Band structures in solids
13. Semiconductors
14. Two-state transitions 2
15. Various quantum phenomena, semi-conductors from quantum wells.
16. The end of term exam

[Keywords] Particles and wave nature, wave function, Schrodinger equation, Hamiltonian matrix, well-type potential and structure of atoms

[Textbooks and Reference Books]

Textbook: Quantum mechanics, Masao Ogata, (shoukabo)

Reference: The Feynman Lectures on Physics V, Richard P. Feynman, (Iwanami)

[Evaluation]Students must receive an overall mark higher than 60% on weekly reports, the mid-term exam, and final exam to pass the course.

[Related courses] Introduction to Material Science, Statistical Dynamics, Electromagnetic Theory, Dynamics　Theory

複素解析演習　Complex Analysis Exercise
[Instructor] Hiroyuki Nakata
[Credits] 2
[Semester] 2nd year-Spring Tue 3
[Course code] T1R02000
[Room] Bldg.Eng.15- 110
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] In the class of "complex analyses exercises", students will be explained about theorems and the formulas regarding the complex analyses, then they will execute exercises regarding them.
[Course objectives] Complex analysis is an indispensable mathematical basic on learning science and engineering. Thus, the students will understand basic theorems and formulas of the complex analysis, and they will concurrently master where attention should be paid in actually using them.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Students will understand basic calculation regarding complex numbers, and a relation between complex numbers and complex plane, so that they will be able to apply the complex numbers to plane geometry. (D-1)	1, 2	Reports/ small test exam	25 %
2	Understand the basic characteristics of complex functions, and be able to derive the Cauchy-Riemann equations and differential of complex functions. (D-1)	3, 4, 5, 6	Reports/ small test exam	25 %
3	Understand how to integrate complex functions, and understand Cauchy's integral theorem and other theorems which make use of it. Understand residue, and how to apply it to definite integrals. (D-1)	8,9,10,13, 14	Reports/ small test exam	25 %
4	Understand the series expansion of the complex function such as Taylor and Laurent expansions (D-1)	11, 12	Reports/ small test exam	15 %
5	Understand that a potential field in 2D can be expressed with complex functions, and how to apply this in physics. (D-3)	15	Reports/ small test exam	10 %

[Plans and Contents] Students will review basic issues at the beginning of the class, and solve exercise questions before starting exercises and a simple test. They will execute exercises mainly with basic questions, and constructive questions will be taken up as needed. Questions intended for applying to various fields of the engineering will be also provided.

1. Learn the basic properties of complex numbers. [Necessary preparation] Know what imaginary units, the four arithmetic operations of complex numbers, and conjugate complex numbers are.
2. Learn how to show complex numbers in polar form and complex planes.【Necessary preparation】Understand how complex numbers are shown in complex planes. Understand absolute values and amplitude in polar form.
3. Learn about applications for complex number plane geometry.【Necessary preparation】Understand the concepts of complex number position and position vectors in complex planes. Also understand magnification and rotation of vectors in a plane.
4. Learn about complex functions.【Necessary preparation】Understand that complex functions can be identified as functions that return two real numbers for two real numbers.
5. Learn about the basic properties of complex functions (poles, continuity, differentiability) .【Necessary preparation】Understand how to find poles, continuity and differentiability, and understand singularities.
6. Learn about differentiability of Cauchy-Riemann equations and complex functions.【Necessary preparation】Understand the Cauchy-Riemann equations and how to derive them.
7. Learn about elementary functions (polynomial functions, rational functions, trigonometric functions, etc.) and their derivatives.【Necessary preparation】Understand conditions for regular system.
8. Learn how to computer complex function integrals.【Necessary preparation】The concepts of composite functions (parameters) are often used in complex integration. Understand differentiation and integration of composite functions.

9. Learn the Cauchy integral theorem.【Necessary preparation】Understand how to derive the Cauchy integral theorem.
10. Learn applications of the Cauchy integral theorem (changing contour integration path, Goursat's theorem, etc.) 【Necessary preparation】Use Cauchy's integral theorem, and understand how to choose a path of integration that avoids singularities. Goursat's theorem is included within Cauchy's integral theorem.
11. Learn about explanation of complex series and convergence of complex series and calculating Taylor expansions. 【Necessary preparation】Understand power series, and how to calculate Taylor expansions.
12. Learn about complex series (calculating Laurent expansions, and types of singularity).【Necessary preparation】Review areas where Taylor expansions can be performed, and understand how to find Laurent expansions. Also, understand that there are different types of singularity.
13. Explain how to find residue, and how to find integral values using residue.【Necessary preparation】Understand what residue is. In addition, review how to do a Laurent expansion on a function.
14. Explain how to apply residue theorem as a method of evaluating real integrals.【Necessary preparation】Understand residue theorem.
15. As application of complex function to physics, explain how complex functions can be applied to showing potential flow and vector fields.【Necessary preparation】The plan is to pay particular attention to potentials in electromagnetism, so students should understand the relationships between electric potential and electrical field vectors in static electric fields.
16. The final exam will be held on entire course content and comprehension evaluated.【Necessary preparation】Review material covered in entire course.

[Keywords] Complex Analysis

[Textbooks and Reference Books] None designated. Students are advised to obtain their own reference texts and workbooks.

[Evaluation] Evaluated by Reports, small test (30 %), interim exam, and final exam. Students must score over 60 points to obtain the credit.

[Related courses] Complex Analysis (G17151001)

[Course requirements] Students have preferably taken courses of Complex Analysis (Code Number G17151001).

[Remarks]This course is related to electrical and electronics engineering learning goal "(D) Acquire Universal Basic Knowledge." A mid-term exam will possibly be given around the course's half-way point, and students will be contacted as to exact date and time.

偏微分方程式演習　Seminar on Partial Differential Equations
[Instructor] Kenji Natori
[Credits] 2
[Semester] 2nd year-Fall-Fri 3
[Course code] T1R021001
[Room] Bldg. Eng. 17-113
[Course enrollment] None
[Candidate]Students of faculty of Engineering
[Course description] Partial differential equation is one of the mathematical tools needed for understanding and describing physical phenomena, such as electromagnetism, mechanics, heat transfer, reaction-diffusion theory. In this class, students will mainly master a second-order linear partial differential equation which will appear in the mathematical physics through exercises.
[Course objectives] In order to analyze a partial differential equation, the students will have to master mathematical tools. In this class, therefore, it is also a purpose that the students will learn partial differential equations as mathematical tools of analyzing natural phenomena as well as some mathematical tools that are useful for engineering in the process of studying partial differential equations.

	Targets of the Subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Through analysis of partial differential equations, be able to use the mathematical tools of engineering such as Fourier series expansions, Fourier transforms, and Laplace transforms.	2, 4, 7-16	Reports, exam	25 %
2	Learn about solutions of first-order linear partial differential equations, and be able to solve them.	1, 3, 5-7	Reports , exam	25 %
3	Learn about solutions of second-order partial differential equations (wave equation, diffusion equation, Laplace equation), and be able to solve them.	1-4, 7-16	Reports ,exam	50 %

[Plans and Contents] The students will be lectured and do exercises with respect to a theme indicated every week. The class will be composed of a lecture using example questions along the theme, and exercises of similar questions. The students will submit solutions for exercise questions every week as a report. This subject includes the contents related to D-1 and D-3 of “Specific Achieving Details” related to a study and educational objective of the department of electrical and electronic engineering.

1. Explanation of exercises and introduction to partial differential equations
2. Review of ordinary differential equations
3. First-order partial differential equations 1 – Lagrange’s partial differential equations
4. First-order partial differential equations 2 – Total differential equations and Charpit’s method
5. Fourier series and Fourier transforms
6. Laplace transforms
7. Classification of second-order partial differential equations and their properties
8. Review of first half of class and assess understanding (with a focus on material from classes 2 to 6)
9. Finite-interval diffusion equations and separation of variables
10. Infinite-interval diffusion equations and solutions using Fourier integrals
11. Wave equations and Laplace equations, and solutions using Fourier transforms.
12. Nonhomogeneous partial differential equations and eigenfunction expansion method
13. Solutions of second-order partial differential equations using Laplace transforms
14. Partial differential equations on rectangular boundaries and Green’s function method
15. Exam (with a focus on material from classes 9 to 13)
16. Solutions to final exam and overall course summary and review

[Keywords] First-order linear partial differential equations, second-order linear partial differential equations, Fourier series expansions, Fourier transforms, Laplace transforms, calculus of difference
[Textbooks and Reference Books] There is no particular text designated, but reference books will be introduced as needed.

[Evaluation] As this is a seminar course, students must attend classes to earn credit. Students will be evaluated on reports, in-class assessment tests (the mid-term exam), and the final exam. In principle, students will pass if they achieve an average mark over 60% on the mid-term exam and final exam, and if the mark falls below this, report results will be added. Reports will not be accepted after problem set solutions are released (i.e. after reports due.)
[Related courses] Students are preferably taking courses of Partial Differential Equations (G17154002)and Applied Mathematics (T1R009001) at the same time.
[Course requirements] Students must have taken courses of Differential Equations (G17153003) and Seminar on Differential Equations (T1R019001).

電気電子工学実験 II Experiment of Electrical and Electronics Engineering II
[Instructor] Chang-Jun AHN
[Credits] 3. 3rd year-Spring Thu 3, 4, 5
[Course code] T1R023001,T1R023002,T1R023003
[Room] Lab in Department of Electrical and Electronics Engineering
[Course enrollment] 80
[Candidate] Specially Registered,and Non-Degree Student.. Students of Electrical and Electronic Engineering System in Department of Electronics and Mechanical Engineering;
[Course description] Students will themselves use measurement devices to implement given experimental assignments, so that they will more understand what is happening, and master characteristics of the measurement devices and method of using these devices.
[Course objectives] It is a purpose that students will create a method for rating comprehending basic principles of the various phenomena, penetrating capability of quantitatively evaluating them, and an availability of these phenomena, and expanding compositional capability of substantiating a method for achieving a desired purpose.

	Targerts of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Gain experience in the use and properties of measuring devices.	Every week	Attitude towards Experiments, Reports	25 %
2	Gain quantitative experience through use of actual equipment.	Every week	Attitude towards Experiments, Reports	25 %
3	Create a brief outline report and learn how to make an organized report.	Every week	Attitude towards Experiments, Reports	25 %
4	Practice cooperation through working in a group, and learn how group discussion can lead to resolution and realization of issues that can't be solved alone.	Every week	Attitude towards Experiments, Reports	25 %

[Plans and Contents] During experiment guidance, students will be distributed with materials and split into a group. Since guidance will be carried out in a classroom, the students should ensure the place on the bulletin. As from the second week, it depends on a group what experiment will be carried out in which week. The students should check the bulletin to ensure the next experiment assignment.

1. Experiment guidance
2. Amplifying circuit experiment (Week 1)
3. Amplifying circuit experiment (Week 2)
4. Logic circuit experiment (Week 1)
5. Logic circuit experiment (Week 2)
6. Measurement with magnetic bodies
7. Measurement with dielectrics
8. Three-phase synchronous generator experiment
9. Three-phase induction motor experiment
10. Operational amplifier experiment
11. Differential amplifier circuit experiment
12. Switching power circuit experiment
13. High-frequency transmission line experiment (I. transmission lines)
14. High-frequency transmission line experiment (II. rectangular waveguides)

[Evaluation]Evaluation will be based upon experimental attitude and experiment reports. Each theme will be complete with the submission of the experiment report; therefore students will not receive evaluations for reports not submitted. Please ensure that all reports are submitted.
[Related courses] Experiment of Electrical and Electronics Engineering I
[Remarks] Since the assignment will be executed with tools within the given time, the students should read "handbook of electric and electronics engineering" by the day when the assignment is done. This subject relates to a study educational goals of the electric and electronics course; (A) communication capability, (B) practice capability, (C) capability of observing and examining an event, and (D) capability of solving problems, and executing power

電気電子工学実験 III Experiment of Electrical and Electronics Engineering III
[Instructor] Chang-Jun AHN
[Credits] 3
[Semester] 3rd year-Fall Thu 3, 4, 5
[Course code] T1R024001,T1R024002,T1R024003
[Room] Lab in Department of Electrical and Electronics Engineering
[Course enrollment] 80
[Candidate] Specially Registered,and Non-Degree Student.. Students of Electrical and Electronic Engineering System in Department of Electronics and Mechanical Engineering;
[Course description] Students will themselves use measurement devices to implement given experimental assignments and summarize the result as a report, so that they will more understand circumstances related to electricity and electronics engineering.
[Course objectives] It is a purpose that students will create a method for rating comprehending basic principles of the various phenomena, penetrating capability of quantitatively evaluating them, and an availability of these phenomena, and expanding compositional capability of substantiating a method for achieving a desired purpose. The students will also master how to write a report, and they will experience with promoting an experiment in cooperation with the group members; summarizing a report of the desired description within the due period, so that they will recharge a social basic capability required as an engineer

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Gain experience in the use and properties of measuring devices.	2,3,4,5,6,7,8, 9,10,11,12, 13, 14, 15	Attitude towards Experiments, Reports	25 %
2	Gain quantitative experience through use of actual equipment.	2, 3, 4, 5, 6, 7,8,9,10,11,1 2, 13, 14, 15	Attitude towards Experiments, Reports	25 %
3	Create a brief outline report and learn how to make an organized report.	1, 2, 3, 4,5,6,7,8,9,10 ,11,12, 13, 14, 15	Attitude towards Experiments, Reports	25 %
4	Practice cooperation through working in a group, and learn how group discussion can lead to resolution and realization of issues that can’t be solved alone.	2,3,4, 5, 6, 7,8,9,10,11,1 2, 13, 14, 15	Attitude towards Experiments, Reports	25 %

[Plans and Contents] Since students will execute an experiment by rotation, it will not generally be the order as listed herein. Students should view the bulletin and ensure what experiment its own groups will do next time.

1. Oscillators
2. DC motors
3. High-voltage experiment
4. Thermoelectric converters 1
5. Thermoelectric converters2
6. Semi-conductor devices 1
7. Semi-conductor devices2
8. Optical transmission 1
9. Optical transmission2
10. Fundamental transmission methods 1
11. Fundamental transmission methods2
12. DC motors and PI control
13. Measuring response characteristics in RC circuits

[Keywords] Electrical and Electronics Engineering, Experiment

[Textbooks and Reference Books] The experiment text will be posted to Moodle for students to download.
[Evaluation] Students will be evaluated with attitude at the experiment and a report on the experiment. Since the experiment for each assignment will be completed when the final report on the experiment is submitted, no grade evaluation for each experiment assignment will be executed unless the report on the experiment is submitted. If the students have difficulty in attending an experiment, preparing a prior report, maintaining the due period of submitting the final report, and attitude at the time of the experiment, these could be reasons for reducing marks.
[Related courses] Experiment of Electrical and Electronics Engineering I Experiment of Electrical and Electronics Engineering II
[Remarks] Since the experiment needs to be so effectively executed within the limited time, the students should read “handbook of electric and electronics engineering” by the day when the assignment is done to understand; summarize the principles and procedures in a prior report; and bring the report with you. The students will not be approved to execute an experiment until prior report checking and obtaining a confirmation seal. This subject relates to a study educational goals of the electric and electronics course; (A) communication capability, (B) practice capability, (C) capability of observing and examining an event, and (D) capability of solving problems, and executing power.

科学技術英語　Engineering English
[Instructor] Hideo Takahashi
[Credits] 2
[Semester] 3rd year-Spring Wed 3
[Course code] T1R025001
[Room] Bldg. GNE.H-41（CALL）
[Course enrollment] 50
[Candidate] 3rd year of Department of Electrical and Electronic Engineering
[Course description] Students will be trained to improve their English communication skills, using English CALL materials, which have been developed by Chiba University using US University Engineering-based English lectures.
[Course objectives] Students will be trained to develop their basic ability to understand short English lectures and to develop vocabulary in science and engineering-based fields.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand content of short lectures given at a natural speed	2～15	Exam	40 %
2	To develop vocabulary in the field of science and engineering for practical use in written paper and oral presentations	2～15	Exam	30 %
3	To improve listening and reading skills as measured by TOEIC	2～15	Exam	30 %

[Plans and Contents] The materials used are Web-enabled CALL materials, English for Science 2, “Introduction of open labs at the engineering department of the University of Colorado, Lectures on Acoustic Phonetics”. These are materials focused on Science and Engineering-based English, and learners will complete a series of listening activities and vocabulary based on sound, text, and image data.

1. Overall guidance and pre-assessment of English ability
2. How to use CALL materials, and learning with CALL
3. Learning with CALL, Vocabulary quizzes Set 1, 2
4. Learning with CALL, Vocabulary quizzes Set 3, 4
5. Learning with CALL, Vocabulary quizzes Set 5, 6
6. Learning with CALL, Listening material Unit test – Unit 1
7. Learning with CALL, Vocabulary quizzes Set 1-6
8. Learning with CALL, Vocabulary quizzes Set 7, 8
9. Learning with CALL, Listening material Unit test - Unit 3
10. Learning with CALL, Vocabulary quizzes Set 9, 10
11. Learning with CALL, Vocabulary quizzes Set 11, 12
12. Learning with CALL, Listening material Unit test - Unit 4
13. Learning with CALL, Vocabulary quizzes Set 13, 14
14. Learning with CALL, Vocabulary quizzes Set 7 - 14, and English ability post-assessment
15. Learning with CALL, Listening material Unit test - Unit 5

[Keywords] CALL, English for Natural Sciences, English Communication Skills
[Textbooks and Reference Books] Handouts
[Evaluation] Evaluated 4 unit tests(40%), 9 small words tests(30%), Command of English final test(30 %)
[Remarks] Students must do at least 90 minutes of self-study a week outside of class. Students who miss both the first and second classes cannot take the course, so students should make sure to attend. For any questions, please contact htaka@faculty.chiba-u.jp.

インターンシップ　Internship
[Instructor] Kang-Zhi Liu
[Credits] 2
[Semester] 3rd year-Fall Intensive
[Course code] T1R026001
[Room]
[Course enrollment] There is no limit in particular, but adjustment with the company is necessary.
[Candidate] Students of Department of Electrical and Electronics Engineering
[Course description]　Students will have working experiences at companies out of the University in view of trainings, and they are not allowed to do recruiting activities and part-time job experiences. The period will be during a summer vacation season between third and fourth grade as a principle; however, it will also be available during a spring vacation season. The implementation period will be for two weeks, or no shorter than 45 hours in total. In order to obtain a teaching certificate of "Information", students must acquire internship related to the information.
[Course objectives] Based on the experiences at the companies out of the University, students will be trained for profession sense and improving the learning effects.

	Targerts of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to use engineering technology to benefit society.			30 %
2	If acquiring the "information" certification, the "Engineering Technology" mentioned above will cover 30%.			30 %
3	Implement examples of problem finding and problem solving abilities.			20 %
4	Gain experience putting logical thinking learned in class to use in a practical way.			40 %
5	Practical engineering theory.			10 %

[Plans and Contents] Students will submit "Working Experience Planning" in advance to the instructor, and after the completion, they will submit "Diary on Internship Working Experience" and "Report on Evaluation of Internship Working Experience", which will be requested by the students to the person in charge at the accepting company, and they will be interviewed.

1. Internships are generally run the summer between third and fourth year, but spring vacation is also possible.
2. Internships run for two weeks, or more than 45 hours.
3. In order to receive teaching certification in "Information", students must engage in an information-related internship.

[Keywords] Craftsmanship, enterprise activity, internship, factory training, profession sense
[Textbooks and Reference Books] Not particularly
[Evaluation]Comprehensively evaluated based on internship work experience diary and internship work experience evaluation report, together with the instructor interview.
[Related courses] Multidisciplinary
[Course requirements] In order to receive teaching certification in "Information", students must engage in an information-related internship.
[Remarks]For students who wish to receive high school teacher certification in "Information," this course will be credited as "Internship – Information-related business practicum," so please apply for credit through the instructor.

制御理論 I Control Theory, Part I
[Instructor] Kang-Zhi Liu
[Credits] 2
[Semester] 3rd year-Spring Mon 5
[Course code] T1R027001
[Room] Bldg.Eng17- 112
[Course enrollment] 90
[Candidate] Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Students will learn the concept of feedback control system, which is a core in the control engineering. The physical variables of plant change with time. The students here will use transfer function as a model to understand basic concept of the classical control theory. They will also master frequency response, which will be used in many fields of the electric engineering.
[Course objectives] In this lecture, students will be explained about basics of the control theory as easy as possible. First, the basic concept of feedback control will be shown with examples of systems around us. Next, the students will learn in what model the control system can be expressed, and basics of the theoretic method for the analysis of system characteristics.

	Targerts of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to use engineering technology to benefit society.			30 %
2	If acquiring the “information” certification, the “Engineering Technology” mentioned above will cover 30%.			30 %
3	Implement examples of problem finding and problem solving abilities.			20 %
4	Gain experience putting logical thinking learned in class to use in a practical way.			40 %
5	Practical engineering theory.			10 %

[Plans and Contents]
1. Basic thinking behind feedback and applications of feedback technology.
2. Mathematical preparation: Elementary functions and Laplace transform.
3. Properties of Laplace transform, inverse Laplace transform.
4. Mathematical models that describe the behavior of physical systems
5. The meaning of linear differential equations that describe time-dependent physical variables
6. From differential equations to transfer functions, the meaning of block diagram and its operation
7. How to compute the time response in dynamic systems
8. Problem set and quiz
9. Stability of dynamic systems
10. Determining stability in dynamic systems
11. Response to sine wave input
12. Nyquist diagram – a graphical method of describing frequency response
13. Bode plot – a graphical method of expressing frequency response.
14. Feedback control system structure and various transfer functions
15. Determining stability via frequency response in feedback control systems, system performance
16. Exam

[Keywords] Dynamic system, model, Laplace transform, frequency response, stability, feedback system, compensator
[Textbooks and Reference Books] Asami Saito and Li Xu: Control Engineering, Morikita Publishing
[Evaluation] Evaluation is given by reports (20%), Practice and small test (30%), and Final exam(50%).
[Related courses] Industrial Mathematics, Complex Analysis, Electric Circuit Theory
[Course requirements] No specific requirements, but students are recommended to understand the content from Electric Circuits I.

[Remarks] Focus is on homework, and no makeup tests are offered. Preparation and review is necessary. Students are expected to gather the material for each section in a portfolio.

制御理論 II　Control Theory, Part II
[Instructor] Kang-Zhi Liu
[Credits] 2
[Semester] 3rd year-Fall　Fri 2
[Course code] T1R028001
[Room] Bldg.Eng 17- 111
[Course enrollment] 80
[Candidate] Students of faculty of Engineering;Students in third year, Student of Past fiscal year and those in the advanced science programs and other faculty permitted to take lectures.Students of Chiba University of Technology.
[Course description]　Students will be lectured about basic theories necessary for executing control system analyses and designs based on the state equation description of the system.
First, they will be lectured about the basic concepts including controllability, observability, stability, pole-zero and system performance. Next, they will be explained about a control method with a state feedback and observer as an entry-level design method. In addition, they will learn the parameterization approach of stabilizing controllers.
[Course objectives] Students will be carefully lectured about what the system control is, what it is useful for in the world, and how it is used. They will be taught about the basic knowledge which they will have to master as a system engineer, with a steadfast base on which they will learn about the system control method at higher level. The system concept herein lectured will be also useful for those specializing in other fields.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of total Course Grade
1	Master the use of state equation to describe systems, methods of modelling, and how to compute solutions.	4,5	Homework, problem sets and quizzes, final exam	20 %
2	Master the methods of analyzing the structural properties of system (poles, zero point, controllability, observability)	6-9	Homework, problem sets and quizzes, final exam	20 %
3	Master system stability, stability conditions, and stability analysis methods.	1,2,10	Homework, problem sets and quizzes, final exam	25 %
4	Understand system performance and evaluation methods, and the relative merits of open-loop and closed-loop systems.	3,11	Homework, problem sets and quizzes, final exam	10 %
5	Be able to apply stabilization methods using feedback (state feedback, observers, stabilization controller parameterization)	12-15	Homework, final exam	25 %

[Plans and Contents] Students will be lectured about basic issues including a system concept, an expressing method, basic properties and performance specification as well as a method of analyzing these; and a method of improving a system performance by introducing a feedback control. The class will be preceded in a lecture style, in which the students will be explained about the description and taking exercises.

1. Review of basic control theory I
2. Stability margins
3. Evaluating system performance 1
4. Expressing system state equations, setting up state equations
5. State equation solutions, linear system response
6. System controllability
7. System observability
8. Poles, zero points, and response
9. Problem sets and quizzes
10. Stability, determining stability with the Routh-Hurwitz and Lyapunov methods
11. Evaluating system performance 2, performance comparison of open-loop and closed-loop systems
12. Stabilization using state feedback (pole placement method)
13. Observer design

14. Stabilization controller parameterization I
15. Stabilization controller parameterization II
16. Final exam

[Keywords] State equation, controllability, observability, state feedback, observer, system performance, parameterization of stabilizing controllers

[Textbooks and Reference Books] Kang-Zhi Liu and Tielong Shen: An Introduction of Modern Control Theory, Baifu-Kan (may be downloaded at http://www.sd.te.chiba-u.jp/lecture.html).

[Evaluation] Evaluation is given by report assignment 20%, Practice and small test 30%, final exam 50%.

[Related courses] Basic Control Theory I

[Course requirements] Have taken Basic Control Theory I.

[Remarks] Focus is on homework, and no makeup tests are offered. Preparation and review is necessary. Students are expected to gather the material for each section in a portfolio.

電力システム Electrical Power System
[Instructor] Kang-Zhi Liu
[Credits] 2
[Semester] 3rd year-Spring Wed 4
[Course code] T1R029001
[Room] Bldg.Eng17- 213
[Course enrollment] About less than 80.
[Candidate] Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student;3rd and 4th year of Department of Electrical and Electronics Engineering.
[Course description] Explain technologies related to power generation, transmission, and distribution.
[Course objectives] Students will understand technologies related to electric power generation, power transmission, and power distribution; and they will have a deep recognition on the outline and importance of the technical fields related to electric energy.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand how the power system is involved in the world, and to explain the importance thereof. To understand various types of generating methods, and examine what it should be in future from the viewpoint of environment and energy resources.	1	Reports and exams	5 %
2	To understand the basics of power system and three -phase circuit, including electric power, per-unit method,three-phase alternative current and transmission system, Y connection and star connection of the loads. To explain physical meanings of active power and reactive power	2, 3, 4	Reports and exams	20 %
3	To perform the power flow analysis about small-sized power system with the impedance of transmission line considered.	5, 6	Reports and exams	10 %
4	To understand the principle of synchronous power generator, power and torque, operating conditions of the power generator connected to the system; and the control method.	7, 8, 9	Reports and exams	20 %
5	To understand the motion equation of power generator, and types of the power generator system stability, and evaluate the transient stability	10, 11	Reports and exams	15 %
6	To understand the relation between active power and frequency, and the calculation of stabilizing control of frequency	12, 13	Reports and exams	15 %
7	To understand basic issues on the relation between reactive power and voltage; and a control method of the reactive power.	14, 15	Reports and exams	15 %

[Plans and Contents]
1. The history of electrical power systems, AC and DC transmissions, and relation with energy and environmental issues
2. Active power, reactive power and their physical meanings, complex power and the per-unit system
3. Symmetrical three-phase AC, transmission systems
4. Y-connection and star connection of loads, three-phase circuit analysis and the per-unit system
5. Power flow equation, power flow calculation
6. DC method for the calculation of power flow
7. Power and torque of synchronous generator
8. Mid-term exam
9. Operational analysis of power generators connected to systems
10. Concepts behind electrical power stability, swing equation, simplification of electrical generator group
11. Steady-state stability, transient stability, and stability criterion

12. Necessity of frequency control, relationship between active power and frequency
13. Frequency control in interconnected systems
14. Relationship between reactive power and voltage
15. Reactive power sources, reactive power control
16. Final Exam

[Keywords] Power system, generation, transmission, distribution

[Textbooks and Reference Books]Satoru Yanabu, Seiichi Kato: Power System Engineering, Tokyo Denki University Press (ISBN4-501-11300-6)

[Evaluation] Students are evaluated by report assignment 20%, interim exam 30% and Final exam 50%. Total score must be over 60points to obtain the credit.

[Related courses] Experiment of Electrical and Electronics Engineering I, II, III, Electric Machinery, Power Electronics

[Course requirements] As a general rule, students must have earned the credits of Electromagnetic Theory I with Exercise, Electromagnetic Theory II with Exercise, Electric Circuit Theory I with Exercise, Electric Circuit Theory ,II with Exercise, Control Theory, Part I.

パワーエレクトロニクス Power Electronics
[Instructor] Yukihiko Sato
[Credits] 2
[Semester] 3rd year-Fall　Mon 2
[Course code] T1R030001
[Room] Bldg Eng.9-107
[Course enrollment] about less than 60
[Candidate] Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Explain the basic points of power electronics, the field dealing with semiconductor power conversion devices and their application.
[Course objectives] Students will understand the principles of the power transformation using a semiconductor power device, and master an operating principle of the basic various semiconductor power transformation apparatuses; impact which the semiconductor power transformation apparatuses will provide; and application of the semiconductor power transformation apparatuses as the infrastructure technology in the modern world.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to explain power conversion principles using switching behavior of semiconductor devices, advantages, problems and basic functions and characteristics of various power-use semiconductor devices.	1, 2, 14, 15	Unit tests, final exam	15 %
2	Understand the operating principles of basic power conversion devices (diode rectifying circuits, thyristor rectifying circuits, DC choppers, invertors), and be able to draw the voltage and current waveforms for each.	3, 4, 5, 6, 8,9,10,11, 12	Unit tests, final exam	50 %
3	Be able to explain harmonic current providing power to power conversion devices and reactive power effects and counter-measures.	7, 12, 15	Unit tests, final exam	20 %
4	Understand the application of power convertors and their trends, and be able to explain how to apply tghem to the benefit of society in relationship to energy and environmental issues.	1, 15	Unit tests, final exam	15 %

[Plans and Contents] The technical field in which opening and closing, converting, and controlling operations of the power with semiconductor switching elements such as MOSFET and IGBT is executed is referred to as power electronics. In the class, students will understand functions and properties of various semiconductor switching devices, and master basic principles regarding the basic power transformation apparatus using these devices. They will understand how important role the power electronics play in our lives and world

1. Overview of Power Electronics – Explain what power electronics means. Show how high-efficiency power conversion can be realized through power semi-conductor switching operations, and explain the issue and important points regarding switching operations. ◆Necessary preparation: Use the internet to research where power electronics can be applied, and their relationship with environmental and energy issues. Read chapter one of the textbook.
2. Functions and characteristics of power semi-conductor devices – Understand the functions, operations, and main characteristics of power semi-conductor devices used in power electronics. ◆Necessary preparation: Read chapter two of the textbook. Also, download and review the datasheets for the power semiconductor devices discussed in class one, and download and read the lecture materials for this class from the course homepage.
3. Basic DC chopper operations – Understand operation of basic DC choppers such as step-down choppers, boost choppers, and up/down choppers, be able to draw voltage and current waveforms in each part, and be able to conduct operating analysis. Do unit test on material in classes one and two. ◆Necessary preparation: read over Electrical and Electronic Engineering Experiments II “switch-mode power supply basics.” ◆Necessary preparation: Read chapter three of the textbook.
4. DC chopper characteristics – Deriving the relational expressions for input/output voltage in operational analsyis of basic DC chopper circuits, and go over input/output power equilibrium. ◆Necessary preparation: Read chapter three of the textbook.

5. Basic inverter operations – Explain voltage-source and current-source single-phase inverter basic operations, and learn about basic inverter operations. Also learn about actual circuit structure and vaoltage and current waveforms in single-phase and three-phase voltage-source converters. ◆Necessary preparation: Read chapter four of the textbook.
6. Inverter control methods – Explain voltage inverter frequency control methods and voltage control, with particularly detail paid to pulse-width modulation principles and characteristics. ◆Necessary preparation: Read chapter four of the textbook.
7. Basic operations of diode rectifying circuits – be able to derive the average output voltage through operational analsyis of each type of diode rectifying circuit, evaluate output voltage ripple factor, and compare performance of single-phase and three-phase rectifying circuits. Unit text on material from classes 3 to 6. ◆Necessary preparation: Read chapter five of the textbook.
8. Characteristics of diode rectifying circuits – Understand characteristics of diode rectifying circuits when smoothing output. ◆Necessary preparation: Read chapter five of the textbook.
9. Basic operations of thyristor diode rectifying circuits – Learn about operating principles in single-phase and three-phase thyristor rectifying circuits. Describe waveform motion in each part. ◆Necessary preparation: Read chapter five of the textbook.
10. Characteristics of thyristor rectifying circuits – Analyse thyristor rectifying circuits operations, and derive average output voltages and other characteristics. ◆Necessary preparation: Read chapter five of the textbook.
11. AC power conversion circuits – Learn about AC power regulator circuits, static source reactive power compensator operating principles. Will also learn the functions and characteristics of typical AC power conversion circuits such as cyclo-converters, matrix converters, etc. Necessary preparation: Read chapter six of the textbook.
12. Harmonics and reactive power generated by power convertors – Go over the effects of harmonics and reactive power Generated by input/output in power convertors, and explain influence evaluation indicators. Necessary preparation: Read chapter seven of the textbook.
13. Points in making power converters – Learn about the structures than generate EM noise in power converters, go over reduction methods, and explain power converter control electrode driving circuits and their power sources. Necessary preparation: Read chapter seven of the textbook.
14. Applications of power converters 1 – Explain operating principles, functions, and characteristics for a variety of Voltage inverter applications. Unit test on material from classes 11 to 13.◆Necessary preparation: Read chapter eight of the textbook.
15. Applications of power converters 2 – Get an outline of circuit systems, operating principles, and characteristics of large capacity frequency converters, insulated DC/DC converters, and high-frequency power sources as typical power converter applications. ◆Necessary preparation: Read chapter eight of the textbook.
16. Final exam – Evaluate student understanding of necessary material from entire course. ◆Necessary preparation:Review material from entire course. Go over solutions from all unit text problems.

[Keywords] Power Electronics, Semiconductor Power Converter, Motor Control

[Textbooks and Reference Books] Textbook SATO Yukihiko 「Fundamentals of Power Electronics」

[Evaluation]Students will be evaluated based upon unit tests conducted at the end of each unit (worth 50% of final mark) and final exam (worth 50% of final mark). Unit tests and final exam sum up to a total of 100 marks, and students must receive a total of 60 marks as laid out in the course purposes and objectives. In order to obtain credit, students must attend all unit tests and the final exam, and receive an average mark of 60% or higher.

[Related courses] Mechatronics Experiments, Electrical Systems, Electrical Energy Converters, Electrical and Electronics Engineering Experiments I, II, III

[Course requirements] In principle, students should have received credit in Circuit Theory I, Joint Exercises, Circuit Theory II, Joint Exercises, and Basic Electronic Circuits.

[Remarks] This course satisfies Electrical and Electronic Engineering learning goal “Specific Performance Goals” (H-3).

基礎電子回路　Elementary Electronic Circuit
[Instructor] Hideo Saotome
[Credits] 2
[Semester] 3rd year-Spring Wed 1
[Course code] T1R031001
[Room] Bldg.Eng.17-213
[Course enrollment] 90
[Candidate]Studentsof faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.; 3rd and 4th year of Department of Electronics and Mechanical Engineering, and those in the advanced science programs and other faculty permitted to take lectures. Students of Chiba University, who permitted to take this course,
[Course description] Students will be explained about basics of the electronic circuits which greatly contribute to the life and industries today having many functions.　The students will be explained about basic properties of pn junction diode, bipolar transistor, and FET, including operation and a circuit design method of these applied circuits.　They will be explained that the functions of IC which will be lectured at the class of an integrated circuit are composed of combined respective electronic devices.　They will be also explained about handling active elements as an equivalent circuit compared to that for passive elements as lectured in the lumped-constant circuit.
[Course objectives]　It is a purpose that students will understand basic properties of a diode, bipolar transistor and field effect transistor; and basics necessary for designing a switching circuit and an amplifying circuit, by which these devices are applied.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to explain the importance of electronic circuit technology in modern technology. Elec (E-2), Elec (H-3), Mech (F-3)	1	Final exam	10 %
2	Be able to explain diodes, transistors and basic FET operations. Elec (E-2), Elec (H-3), Mech (F-3)	2, 3, 4, 12	Final exam	30 %
3	Understand the basics of switching circuit design. Elec (E-2), Elec (H-3), Mech (F-3)	3, 5, 6	Final exam	30 %
4	Understand the basics of amplifying circuit design. Elec (E-2), Elec (H-3), Mech (F-3)	7,8,9,10, 11, 13	Final exam	30 %

[Plans and Contents] Students will learn basics required for an electronic circuit, a diode property, switching property of a bipolar transistor; a static characteristics of a bipolar transistor; a non-steady multi-vibrator; a single steady multi-vibrator; a dual steady multi-vibrator; an amplifying circuit using a bipolar transistor; FET (field effect transistor) basic property; an amplifying circuit using FET; an equivalent circuit with h parameter; a differential amplifying circuit; and a test

1. The necessary fundaments of electric circuits: Touch upon the roles and applications of electric circuits in engineering. Learn about the importance of electric circuits, and discuss the general attitude of the course.
2. Diode properties – Discuss pn junction diodes. Discuss characteristics of forward and reverse voltage and current and dynamic properties during switching.
3. Zener diode properties – Explain the properties of constant-voltage Zener diodes and circuits they can be used in.
4. Bipolar transistor switching characteristics – explain pnp and npn bipolar transistors, and their on-off operation.
5. Biotransistor static characteristics – explain DC operation of bipolar transistors i.e. static characteristics.
6. Astable multivibrators – explain the operating principles of astable multivibrators used as oscillator circuits.
7. Monostable multivibrators – explain the operating principles of monostable multivibrators as used in pulse-shaping circuits, etc.
8. Bistable multivibrators – explain operating principles of bistable multivibrators used in flip-flop memory circuits.
9. Amplifying circuits using bipolar transistors 1 – explain bipolar transistors characteristics regarding small signal input. Will also explain operations and how to design various other amplifying circuits.
10. Amplifying circuits using bipolar transistors 2 – continue explanation from class 7.
11. Amplifying circuits using bipolar transistors 3 – continue explanation from class 8.
12. Equivalent circuits by their h-parameters – explain equivalent circuit constant h-parameter used in transistor operations.
13. Differential amplifying circuits – Explain differential amplifiers op-amp input circuits as learned in Integrated Circuits. Explain circuit operations in bipolar transistors and FETs.

14. Basic properties of FETs – discuss the existence of p-channel and n-channel type FETs and their behavior in DC circuits, i.e. their static characteristics.
15. Amplifying circuits using FETs – Explain FET small signal input characteristics. Will also explain operations and how to design various other amplifying circuits.
16. Final exam – quantify student understand of lecture content.

[Keywords] diode, transistor, FET, multivibrator, differential amplifier, h parameter

[Textbooks and Reference Books] No text is designated, but students should choose a reference text to suit them.

[Evaluation] Students will be evaluated by exams. The score must be over 60points to obtain the credits.

[Related courses] Electric Circuit Theory I, Electric Circuit Theory I with Exercise, Semiconductor Physics

[Course requirements] Students must have taken courses of Electric Circuit Theory I, Electric Circuit Theory I with Exercise. And preferably takenthe courses of Semiconductor Physics.

[Remarks] This subject is a replacement subject of Electronic Circuit I.

集積電子回路 Integrated Electronic Circuit
[Instructor] Ken-ya Hashimoto
[Credits] 2
[Semester] 3rd year-Fall Wed 4
[Course code] T1R032001
[Room] Bldg. Eng. 17- 113
[Course enrollment] about 100
[Candidate] Students of faculty of Engineering,
[Course 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.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the operating principles of analog electronic circuits, and learn the basics of analysis and design.	1-4	Report	30 %
2	Understand the operating principles of op-amp circuits, and learn the basics of analysis and design.	5-8	Report	20 %
3	Learn the operating principles of microprocessors and other digital circuits and learn the basics of analysis and design.	9-12	Report	30 %
4	Understand the basics of high-frequency circuits, and in particular, the differences between them and low-frequency circuits.	13-15	Report	20 %

[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.

伝送工学 Transmission Engineering
[Instructor] Yashiro Kenichiro
[Credits] 2
[Semester] 3rd year-Fall Mon 4
[Course code] T1R034001
[Room] Bldg.Eng. 17- 213
[Course enrollment] 80
[Candidate]Specially Registered Non-Degree Student and 3rd year of Department of Electrical and Electronics Engineering.
[Course description] Logical handling of the transmission lines can be classified into a distributed constant circuit analysis method and an electromagnetic field analysis method. In this lecture, a method of analyzing propagation properties of a transmission line as a distributed constant circuit will be described, and then a method of investigating propagation properties according to Maxwell equation will be explained.
[Course objectives] In order to transmit data in large capacity at high speed and between a long distance, it is necessary to consider properties that the transmission line has. A signal wave form to be transmitted will be distorted in wave form, and reduced in amplitude due mainly to attenuation and dispersion of the lines. To examine the attenuation and dispersion for a typical line, understand the basic concept.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand how reflection/transmission occurs through the differences in propagation properties by treating transmission lines as distributed parameter circuits. (Elect E-2)	1, 2	Final exam	20 %
2	Understand how dispersion and attenuation affect waveform transmission by treating transmission lines as distributed parameter circuits. From this, understand the desired propagation conditions in transmission lines.(ElecE-2)	3, 4, 5, 6	Final exam	20 %
3	Understand the basic points of EM field analysis on transmission lines, and how they can be classified into TEM, TE, TM and hybrid modes. Understand how to calculate transmitted power. (Elec E-2)	7, 8	Final exam	20 %
4	Using coaxial transmission lines as an example, understand transmission line dispersion relationships, and how to calculate attenuation. (Elec E-1)	9, 10, 11	Final exam	20 %
5	Understand how to classify dielectric lines, optical fiber, etc., and how line parameters affect classification. (Elec E-1)	12, 13, 14, 15	Final exam	20 %

[Plans and Contents] Students will be discussed about handling a transmission line as a distributed constant circuit in the first part, and an electromagnetic analysis of a transmission line in the second part of the class.

1. Basic equations for distributed parameter lines – Derive the telegraph equation from circuit parameters using Kirchhoff’s laws. Will discuss steady voltage and current waveform propagation in distributed parameter circuits, but focus will be on transient phenomena.
2. Step response in transmission lines – consider TEM wave propagation in transmission lines, and based on physical intuition, think about step response in transmission lines terminating in a simple load. Discuss the principles of a measurement method called time domain reflectometry (TDR).

3. Laplace transforms – learn how to treat transient phenomena in distributed parameters mathematically.
4. Transient response in infinite-length distributed parameter lines – Discuss how to use the Laplace transform on transient phenomena in distributed parameter lines. Think about initial conditions and other boundary conditions. Particular focus will be placed on distortionless lines, which allow waveforms to propagate without distortion.
5. Transient response in finite-length distributed parameter lines – continue to discuss how to use the Laplace transform on transient phenomena in distributed parameter lines.
6. Fast Inversion of Laplace transform – introduce the fast inversion of Laplace transform, a numerical calculation method for use on finite lines, which are particularly difficult to use inverse Laplace transforms on.
7. Maxwell's equations – derive suitable equations for treating guided EM waves starting from Maxwell's equations. Discuss the classification of TEM waves, TE waves, and TM waves.
8. Boundary conditions and EM wave transmitted power – explain the necessary boundary conditions for analyzing transmission lines. Review Poynting's theorem, and discuss how to calculate transmitted power in transverse EM field components by introducing wave impedance.
9. Ideal co-axial lines – consider co-axial lines to be perfect conductors, and find the TEM mode EM field distribution. Use that distribution to find transmitted power and characteristic impedance.
10. Boundary conditions on the surface of a good conductor – consider the situation in which a planar wave is incident on a good conductor, and discuss how energy lost within the conductor can be calculated through the magnetic field distribution on the perfect conductor surface using surface resistance principles.
11. Co-axial lines with losses – calculate co-axial loss and circuit parameters from the EM field distribution found in the previous class. Will also discuss design methods that minimize propagation loss in co-axial lines.
12. Cylindrical waveguides – Explain how a radio wave can propagate in a metallic tube in mid-air. Specifically, consider the tube to be a cylindrical waveguide, and discuss propagation mode (EM wave state) within the tube.
13. Dielectric slab waveguide (2D optical waveguides) – discuss the simplest 2D dielectric slab waveguide as it appears in dielectric and optical waveguides.
14. Optical fiber waveguides – overview of optical fiber waveguides as a whole, consider propagation principles in step-index type refractive-index distribution and graded-index fibers, and discuss propagation characteristics.
15. Dielectric waveguides (optical fibers) – consider propagation characteristics in single mode optical fibers.
16. Final exam

[Keywords] Reflection, Transmission, Distortion, Attenuation, Dispersion relation, Distributed constant circuit, Transient phenomena, Maxwell equations, Boundary conditions, Guided mode, Perturbation method

[Textbooks and Reference Books] Naito Yoshiyuki: Introduction to Information Transmission, Shoko-do. Fujisawa Kazuo: Microwave Circuits, Corona Pub. Abe Hidetaro: Microwaves, University of Tokyo Press. Konishi Yoshihiro: Fundamentals of Microwave Circuits and its Applications, Sogo Denshi Pub. Hosono Toshio: Fast Inversion of Laplace Transform, Kyoritsu Pub..

[Evaluation] Evaluation will be given by final exams. The score must be over 60 to obtain the credits.

[Related courses] Electromagnetic Theory, Electromagnetic Wave Engineering

[Course requirements] Students must have taken courses of Electromagnetic Theory1,2,3and Electromagnetic Theory1,2,3 with Exercise1,2,3 Electric Circuit Theory II with Exercise.

[Remarks] The classes will be carried out with a projector, and a simple quize will be given instead of having a roll call every time. This subject covers advanced materials related to "obtaining expertise" as a learning education goal of the electric and electronic course, and the questions emphasizing on a concept based on the basic academic ability instead of merely learning by heart will be set at the term-end exam

半導体物性 Semiconductor Physics
[Instructor] Kazuhiro Kudo
[Credits] 2
[Semester]3rd year-Spring Wed 2
[Course code] T1R035001
[Room] Bldg.Eng. 17- 214
[Course enrollment] No limit
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] A semiconductor is an extremely important substance in producing various electronic devices and optical devices, including an integrated circuit as represented by CPUs and memories; control circuits for many home electric appliances; elements for control such as motors and robots; control circuits such as automobiles and electric trains; light-emitting diodes for displays and illuminations; and semiconductors for CDs and DVDs, and the semiconductor is also referred to as “Rice of Industry”. In this lecture, students will learn behaviors of electrons in the semiconductors; basics for understanding an operating mechanism of the semiconductor devices and the design guideline, including the semiconductor properties (electric property and optical property) and the characteristics; and electronic transport property in pn junction.
[Course objectives] It is a purpose that students will understand how the electric properties of the semiconductors differ from those of metals and insulators through the energy band theory. It is a purpose that the students will learn about adding impurities into the semiconductors which makes two types of semiconductors, p-type and n-type; and a rectifying mechanism formed by junctioning both, so that they will understand property in pn junction as a basic structure of a device.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Explain solid crystal structural periodicity and symmetry, how to describe them, and explain lattice vibration, physical properties as fundamental parts of understanding the electric properties of semiconductors.	1, 2, 7	Report exam	15 %
2	Learn how to describe semiconductor properties using band theory, and be able to explain the differences between the physical properties of semiconductors and the properties of metallic or insulating materials.	3, 4, 5, 6, 7	Report exam	25 %
3	Be able to explain how to form p-type and n-type semiconductors through the addition of very small amount of impurities, how those properties (i.e. electrical characteristics) can be used in a broad range of applications, and the properties of each type. Will also explain transport and rectifying properties of the two types at contact points between two semiconductors and between a metal and a semiconductor.	8,9,10,11, 12, 13, 5, 6, 7	Report exam	40 %
4	Be able to explain optical and thermal properties of direct and indirect transition semiconductors using band theory.	14, 2, 5, 6	Report exam	20 %

[Plans and Contents] Students will describe the semiconductors according to the band theory, and study in details statistic distribution of electrons and transfer mechanism in intrinsic and extrinsic semiconductors, and understand these. They will also study in details and understand behavior of the electrons in the magnetic field, a pn junction of the semiconductors, a transport mechanism of carriers at the contact section between the semiconductors and the metals. They will understand an optical property and a thermal property of the semiconductors from the band theory. They will prepare and review according to a degree of understanding.

1. Fundamental semiconductor properties – go over the role of semiconductor devices in electrical and mechanical engineering and their importance and physical characteristics. Explain solid crystal structural periodicity and symmetry, how to describe them, and explain electrical and physical properties as fundamental parts of understanding the electric properties of semiconductors.

2. Basic properties of lattice vibration – analyze mechanical model of 1D lattices constructed all of same atoms and of different atoms, learn about the different types (modes) of lattice oscillators and their characteristics, and understand how lattice oscillators have a large influence on properties such as those in semiconductors.
3. Band theory in solids I – start with a qualitative understanding of the physical phenomena: electronic states in a solid differing from that in a discrete atom, in that it is not discrete but continuous, i.e. can be described as a band state. Next, use the free electron model as a foundation to analyzing electrons in a crystalline solid, and learn the basics of describing electron behavior.
4. Band theory in solids II Understand how to use solutions to the free electron model, and how to describe electron state density, discuss Fermi energy surfaces, electron state density as energy functions in wave number space.
5. Band theory in solids III Using the Kronig-Penney model, analyze electron behavior in a crystalline solid (in a periodic potential), derive energy band theory, and understand how electron energy can be in a band state.
6. Band theory in solids IV Electrons, holes, and effective mass: analyze the behavior of electrons as carriers in semiconductors, and learn the concepts of effective mass and holes. Understand the energy band structure and characteristics of conductors, semiconductors, and insulators.
7. Overall practice and mid-term exam – do numerical drills to gain a more complete physical image regarding band theory in solids. Will also confirm comprehension through a mid-term exam.
8. Intrinsic and extrinsic semiconductors – understand the reasoning behind adding impurities to control carriers in semiconductors and the physics regarding impurity levels. Learn the concept of effective density of states and how to analyze carrier density.
9. Fermi levels and quasi-Fermi levels – describe the importance of Fermi level in describing semiconductors, and analyze carrier density and the temperature-dependence of Fermi level. Learn how to describe carrier density in a non-thermal equilibrium state using quasi-Fermi level.
10. Semiconductor electron conductor mechanism I – understand conduction mechanism of carriers in a semiconductor (electrons and holes), carrier scattering, drift, diffusion, generation, and recombination. Derive Einstein relation and understand the relationship between carrier diffusion and drift. Understand the behavior of carriers in a magnetic field.
11. Semiconductor electron conductor mechanism II – derive carrier flow in an applied electric field (current), quasi-Fermi level gradient relationship, and minority carrier continuity equations; understand carrier behavior in non-thermal equilibrium under an applied external field.
12. Learn more detail about current and voltage characteristics in semiconductor pn junctions (existence of rectification), understand carrier transport characteristics in junctions. Understand bias voltage dependence in depletion layer capacitance as formed in junctions.
13. Characteristics of semiconductor-metal contact – learn in detail about how current and voltage characteristics change at contact points between semiconductors and metals through semiconductor conductive characteristics and metal work function.
14. Optical physics and thermoelectric characteristics – understand the interaction of semiconductors and light, and the characteristics of direct transition and indirect transition semiconductors. Understand the thermoelectric Seeback and Peltier effects in semiconductors.
15. Review lecture to assess comprehension of the fundamental points of semiconductor properties.
16. Examination to test student knowledge and understanding regarding the purposes and objectives of each lecture in the course.

[Keywords] Crystal Structure, Lattice Vibration, One-electron Approximation Model, Kronig-Penney model, Energy Band, Electron and Hole, Intrinsic Semiconductor, Extrinsic Semiconductor, n-type Semiconductor, p-type Semiconductor, Mobility, Conduction Band, Valence Band, Forbidden Band, Fermi Level, Fermi-Dirac Distribution Function, Effective Mass, Density of States, Minority Carrier, Majority Carrier, Carrier Continuity Equation, Einstein Relation, pn Junction, Schottkey Diode, Depletion Layer, Diffusion Potential, Diffusion Current, Junction Capacitance, Hall Effect, Fundamental Absorption Edge, Direct (Indirect) Transition, Photoconduction, Seebeck Effect, Peltier Effct

[Textbooks and Reference Books]: Semiconductor Physics (Handoutai Kougaku) (Kiyoshi Takahashi: MORIKITA PUBLISHING Co.), Semiconductor Physics (Handoutai Bussei) (Makoto Konagai: BAIFUKAN CO.)

[Evaluation] Exam and report – to assess comprehension of the material, students will be evaluated on their achievement of the course objectives through testing (with exam and report) of their understanding of the fundamental properties of semiconductors (rules regarding cheating and report due dates will be strictly adhered to.)

[Related courses] Introduction to Material Science, Semiconductor Devices, Electron Devices, Optical Electronics.

[Course requirements] Students are recommended to have taken Introduction to Material Science and Quantum Mechanics, Statistical Dynamics.

[Remarks] Questions (office hours): after lectures or by appointment.

応用電子物性 Applied physics of electronic property
[Instructor]　Shin-ichi Wakabayashi
[Credits] 2
[Semester] 3rd year-Fall Tue 5
[Course code] T1R036001
[Room] Bldg End17- 213
[Course enrollment] About less than 80
[Candidate] Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Electronic physical property in the solid deeply relates to development of the electronics. Students here will learn basics of the solid physics as well as important issues of the electronic physical phenomena. The students will examine general properties of the electrons in the solid based on the quantum mechanics and statistical dynamics, and understand the basic concepts and basic principles. They will discuss on important phenomena and device application, including the electric conductivity, optical electronic physical property, electricity, thermal property, magnetism, superconductive phenomena.
[Course objectives] Students will master basics of the solid electronic physical property. They will deeply understand basic issues from the principles, so that they will comprehend overall image of the electronic physical property, and train foresight and applied skills to various phenomena. They will understand the relation between characteristics in the electron state and physical property from examination of the quantum mechanics and statistical dynamics as a base. Based on this, they will learn expression mechanism of the important phenomena and the properties, including the electric conductivity, optical electronic physical property, electricity, thermal property, magnetism, superconductive phenomena, and understand the device application.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Abstract and acquire the basic knowledge of Quantum Mechanics and electron state in solids.	1, 2	Report exam	10 %
2	Understand electron properties in metal using free electron theory.	3, 5	Report exam	10 %
3	Understand electrical conductance using the Drude model and the Boltzmann equations.	4, 5	Report exam	10 %
4	Understand the principles and phenomena behind optical processes and dielectric properties.	6, 7, 8	Report exam	20 %
5	Understand the principles and phenomena behind lattice vibration and thermal property.	9, 12		10 %
6	Understand electron orbital motion in magnetism and characteristics of spin contribution, and understand paramagnetic, diamagnetism, ferromagnetism expression mechanisms.	10, 12	Report exam	10 %
7	Understand general superconductive phenomena and related devices.	11, 12	Report exam	10 %
8	Understand fabrication methods and measurement techniques of rerated materials and devices.	13		10 %
9	Gain an overview of new material and device applications.	14, 15	Report exam	10 %

[Plans and Contents]
1. Introduction: outline of electron properties in solids and explain relationship to electronics.
2. Solid bonds and electron state: after reviewing basic quantum mechanics, solid bonds and electron state: consider the difference between bonds and bands in solid bonds. Understand electron state in a solid, learn the Bloch theorem, and discuss the mechanism that forms energy bands in a crystal potential.
3. Free electron theory: understand electron properties in metal as a free electron Fermi gas. Consider electron state in a box, and discuss Fermi surfaces and electron heat based in state density and Fermi distributions.

4. Electrical conduction: express electrical conductivity in equation form, and use Drude theory to understand the concept of mobility. Consider temperature variation in electrical resistance, and discuss the effect of scattering. Learn the Boltzmann transport equation to overcome the weak points of Drude theory. Also, consider electron motion in a magnetic field, and understand the characteristics of electrical conductance tensors.
5. Electron device applications: consider the junction of metal and semiconductor, current through the junction, and understand diodes, transistors and the related electron device applications.
6. Dielectrics: explain the electrical polarization generation mechanism, and understand the characteristics of ferroelectric and antiferroelectric bodies.
7. Optical characteristics: think about complex permittivity using Maxwell's equations in matter. Consider permittivity using the Drude and Lorentz models, and understand frequency dependence. Consider basic absorption processes using quantum mechanical perturbation theory, and learn about exciton effect.
8. Optical device applications: understand laser diode, light emitting diode, photovoltaic cell and the related optical device applications.
9. Lattice vibration and thermal property: Learn about phonon, lattice specific heat, and lattice specific heat by phonon, heat conduction and thermoelectric effect.
10. Magnetism: electron orbital motion and spin contribution in regards to magnetic moment. Learn about ion paramagnetism and Pauli spin paramagnetism as paramagnetic structures, and understand Curie's law. Consider diamagnetism due to the contribution of orbital motion. Understand ferromagnetism as a molecular field approximation, and explain magnetic domain structure.
11. Superconductivity: explain the zero of electrical resistance and the Meissner effect, learn phase-transition thermodynamics. Discuss superconductor generation mechanism from the point of view of a cooper pair Bose-Einstein condensate, and understand superconductive current. Consider Josephson effect due to tunneling.
12. Thermal, magnetic and superconductive device applications:
13. Fabrication methods and measurement techniques: Understand fabrication methods and measurement techniques of rerated materials and devices.
14. New materials and device applications: learn about the characteristics of organic electronic material and other new materials and applications in devices.
15. Summary and comprehensive practices

[Keywords] Free electron theory, Energy band, Fermi distribution, Electrical conductivity, Optical characteristics, Dielectric, Magnetism, Superconductivity, Boltzmann transport equation, Drude and Lorentz model, Curie's law, Pauli paramagnetism, Bose-Einstein condensate, Meissner effect, Josephson effect

[Textbooks and Reference Books] Solid State Physics for Engineering Students (Kotai Butsurigaku – Kougaku notameni) (Makoto Okazaki, SHOKABO TOKYO), Kotai Butsurigaku (Hiroo Komura, ASAKURA), Introduction to Solid State Physics I, II (Charles Kittel, MARUZEN)

[Evaluation] Students must receive a total mark over 60% on their midterm exam, reports, comprehensive practice, and final exam.

[Related courses] Introduction to Material Science, Semiconductor Physics, Semiconductor Devices, Electron Devices, Optical Electronics.

[Course requirements] Students are recommended to have taken Introduction to Electromagnetism 1, Introduction to Electromagnetism 2, Introduction to Material Science, Statistical Dynamics, and Quantum Mechanics.

[Remarks] This course serves as a replacement for Fundamental Electronic Properties of Solids.

半導体デバイス Semiconductor Devices
[Instructor] Yoshihito Ishitani
[Credits] 2
[Semester] 3rd year-Fall Wed 2
[Course code] T1R037001
[Room] Bldg.Eng 17- 212
[Course enrollment] No limit
[Candidate] Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student.
[Course description] It is not too much to say that brains of the apparatuses in the works are all made of semiconductor devices, including electric products such as personal computers, mobile phones; control parts of the power devices; and electronic machinery products such as robots, automobiles and rockets. In this lecture, students will learn the basics of the operating principles (DC property and AC property) for diodes, bipolar transistors, and field effect transistors, which are the most important basic devices in the semiconductor devices. They will also learn basics of the heterostructure in which the compound semiconductors are utilized, and the quantum well structure, and basic property of the optical devices mainly including light-emitting devices which are applied by these structures
[Course objectives] If p type semiconductors and n type semiconductors are structured with two layers, diodes will be provided while they will be transistors and thyristors if they are tactfully structured with three layers or four layers. Running electrons and holes on a boundary surface between the insulators and the semiconductors will form field effect transistors. Forming electronic and optical devices with new functions can be also formed by drastically changing a ratio between electronic current and hole current flowing through the junction, and causing confinement effect between light and electrons, and expressing the quantum effect subject to thinner layer thickness if the hetero junction is formed to multiple layers on different types of semiconductors with different band gap. In this lecture, students will learn in details and understand operating principles of various devices prepared by the semiconductors, and the characteristics thereof. Achieving goals of the students are as follows: 1. To explain difference and characteristics between ideal semiconductors and actual semiconductors2. To explain operating principles and property of the transistors
3. To explain operating principles and property of the field effect transistors4. To explain a design method and operating property of the light-emitting devices and light-receiving devices.

	Targets of the Subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	That how the physical properties of the semiconductor material or are used in the semiconductor device, to understand and measurement techniques of physical properties	1-10	exam and report assignment	40 %
2	Can explain the characteristics and basic theory of operation of transistor device, such as a field effect transistor.	7-10,13	exam and report assignment	30%
3	Can explain the characteristics and operating principle of an optical device such as a light emitting device and receiving device	1-10, 14	exam and report assignment	30%

[Plans and Contents] Students will learn in details, with the knowledge on the semiconductor physical property and the electronic circuits as basics, about pn junction diodes, which are the most important basic device structures in the semiconductor devices, structure between major carrier current components and minor carrier current components flowing through the junction upon applying voltage, and structure ratio between electronic current components and hole current components in the overall current to understand these. They will also learn in details about the bipolar transistors, and the field effect transistors as basic amplifying devices, including the operating principles and the characteristics. They will also learn the operating principles of power devices such as thyristors, and optical electron devices for light-emitting and light-receiving. They will also learn and understand basics of the hetero junction electron and optical devices, which make use of feature in physical property of the compound semiconductors.
1. Introduction semiconductor electronic energy band structure

2. From the point of view of device operation 1. - - main physical properties of the
3. From the point of view of device operation 2.-carrier scattering mobility, doping of semiconductor electronic structure
4. Carrier conduction characteristics, measurement techniques
5. Differences in material properties and impact on the device characteristics
6. The layer structure of metal-semiconductor-insulator band diagram 1
7. layer structure of the metal-semiconductor-insulator band diagram 2
8. exercises (quiz)
9. For current semiconductor, equation diffusion equation, continuous, SRH statistics
10. Bipolar transistor 1
11. Bipolar transistor 2 junction capacitance Frequency and characteristics
12. MOS transistors, field-effect transistor 1
13. MOS transistors, field-effect transistor 2
14. Solar cells, LED, and other optical devices
15. Comprehensive confirmation

[Keywords] pn junction diode, minority carrier, metal-semiconductor interface, insulator-semiconductor interface, bipolar transistor, MOS type field effective transistor(FET), high electron mobility transistor, Schottky diode, photoconduction effect, solar cell, photodiode, light emitting diode, diode laser, quantum well pn

[Textbooks and Reference Books] reference books are “Semiconductor devices” 2nd Edit. S.M.Sze, Sangyotosho, “Introduction of semiconductor devices”, N. Shibata, Shokodo excellently written semiconductor device textbook used worldwide.

[Evaluation]Reports and exams: to assess understanding of lecture material, students will be tested on their achievement of lecture objectives in the fundamental properties of semiconductors.

[Course requirements] Students have preferably taken course of Semiconductor Physics、Elementary Electronic Circuit.

電子デバイス Electron Devices
[Instructor] Kazuhiro Kudo
[Credits] 2.
[Semester] 3rd year-Fall Tue 3
[Course code] T1R038001
[Room] Bldg.Eng.17- 112
[Course enrollment] Limit to 60
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student..
[Course description] Students will learn main electron devices (such as semiconductor devices, electron tube devices, photoelectric transformation devices, and display devices), including the structure, basic operating principles, and applied fields.
[Course objectives] It is a purpose that students will observe how various electron devices operate and what they are used for from the view points of the principle, structure, and application; and they will obtain wide range of the knowledge on the electron devices. It is a goal that the students will cultivate the physical intuition that a comprehensively understanding of the electron devices in conjunction with the basic knowledge on the electronic engineering with minimizing the expression in formula

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the basics of semiconductor physics.	1, 2	Report, practice	10 %
2	Understand the basic operating principles of semiconductor devices.	3, 4, 5, 6, 7	Report, practice	20 %
3	Understand the characteristics and operating principles of high-power and microwave semiconductor devices.	8, 9, 10	Final exam	25 %
4	Understand the basics of electron phenomena in vacuum and the main characteristics and operating principles of electron vacuum tubes.	11, 12	Final exam	25 %
5	Understand the characteristics and operating principles of photoelectric conversion devices, display devices, etc.	13, 14, 15	Final exam	20 %

[Plans and Contents] Students will be lectured about the major devices (such as semiconductor devices, electron tube devices, photoelectric devices, and display devices), which electronically operate, including the structure, the basic operating principles. They will also be explained about examples of applied devices and range of use for the electron devices. If necessary, they will more understand the subject through relevant exhibitions, reports using Internet, as well as preparation and review.

1. Basic electronic properties: explain the basic electron behavior and physical properties to understand electronic devices.
2. Basics of electronic devices: explain the fundamental principles and structures in electronic device operation.
3. Basics of metals/semiconductors, pn junctions: explain the basic semiconductor device structures and electrical characteristics for metal-semiconductor/semiconductor-semiconductor junctions.
4. Semiconductor diodes: learn about rectifying, Ohmic contacts, and Schottky junctions in current and voltage characteristics.
5. Bipolar transistors: explain npn and pnp junction transistor structures and operating principles, and understand their fundamental device characteristics.
6. Field effect transistors: explain metal/insulator/semiconductor electronic structures, band structures and basic characteristics, and understand their operating principles.
7. Overall summary of first half of course – deepen understanding through midterm problem set and report.
8. High-power semiconductor devices: explain device structures and design in semiconductor high-power devices, and learn their applications.
9. Microwave semiconductor devices 1: explain electronic device structures and operating principles of high-frequency and microwave devices.

10. Microwave semiconductor devices 2: explain electronic device structures and device operations of high-frequency and microwave devices.
11. Basics of electron phenomena in vacuum: explain electron phenomena in vacuum to understand the device operation of vacuum tube devices.
12. Microwave electron tubes: explain high-frequency devices and microwave vacuum electron device structures and operating principles.
13. Photoelectric conversion devices: review the interaction between light and electron in semiconductors, and explain device structures and operating principles of solar cells, optical sensing devices, etc.
14. Display devices: explain typical displays using electron tubes, liquid crystal, plasma, LEDs, etc.
15. Sensors, comprehensive practice: explanation of pressure sensors and other physical sensors to chemical and biosensors. Will also conduct comprehensive practice.

[Keywords] Semiconductor, pn Junction, Diode, Transistor, Vacuum Tube, Photoelectric Conversion Device, Display Devices, Sensor Devices

[Textbooks and Reference Books] Reference Books: 1. Electron-Device Engineering (Denshidebaisu kougaku) (Tadakuni Fujii: CORONA PUBLISHING Co.) 2. Solid-State Electronics (Kotai Denshi Kougaku) (Akio Sasaki: SHOKOUDOU PUBLISHING Co.), etc.

[Evaluation] Students will evaluated with an overall mark covering reports submitted throughout the course and the final exam. Students will be judged on their understanding of the basic principles of electronic devices, and be able to appropriately explain them using their own words (rules regarding cheating and report due dates will be strictly adhered to.)

[Related courses]: Introduction to Material Science, Semiconductor Devices, Applied physics of electronic property

[Course requirements] Students have preferably taken courses of Electromagnetic Theory, Statistical Dynamics, Elementary Electronic Circuit, Introduction to Material Science, Semiconductor Physics.

[Remarks] Students are expected to attend the CEATEC JAPAN conference or other related conferences at Makuhari Messe and tour the electronic device-related booths, and the submit a report for added marks. Students can sign up online for free.

計算機の基礎　Introduction to computer hardware
[Instructor] Seiichi Koakutsu
[Credits] 2
[Semester] 3rd year-Spring Tue 2
[Course code] T1R039001
[Room] Bldg.Eng- 17- 212
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Students will be lectured about the basic operating principles of the computers, particularly of the hardware. They will be lectured in details about number expressions, from the logical algebra to the principle of flip flop, up to designing circuits with the principle, for a purpose of performing analyses and designs of the combined circuits and the sequential circuits which are basics of the hardware.
[Course objectives] The computers used in the world are in wide variety including persona computers; a large-sized computers used at the classes of the Information Processing; office computers used in the companies; built-in type computers built in the home electric appliances and automobiles; however, the operating principles of these computers are almost identical. In this lecture, students will understand the operating principle of a general computer, and the basics of the hardware which comprises the computer. If the students take this course, they will be able to perform addition, subtraction, multiplication and division of binary numbers; simplify the logical formulas; design combinational circuits; draw the state transition diagrams; derive the property equations from the state transition diagrams; convert flip-flop; design counter circuits; and design specific pattern detection circuits. They will also be able to explain the basic operating principle of the computers.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to do the four basic operations in binary.	1, 2, 3	Final exam	10 %
2	Derive logical formulas from the truth table, and be able to simplify them.	4, 5, 6	Final exam	20 %
3	Be able to design a combinational circuit.	7, 8, 9	Final exam	30 %
4	Be able to create state transition diagrams, derive the characteristic equations, and implement flip-flop conversion.	10,11, 12	Final exam	20 %
5	Be able to design a sequential circuit.	13, 14	Final exam	20 %

[Plans and Contents]
1. Overview – discuss computer history and explain fundamental computer structures and operating principles. Necessary preparation: Read chapter 1 in the textbook.
2. Values and expressions – discuss how to express numbers using only the digits 0 and 1. Describe in particular detail conversions between decimal and binary, and how to express negative values. Necessary preparation：Read from 2.1 to 2.6 in the textbook.
3. Numerical data operations – explain addition and subtraction of binary numerical data and multiplication calculations. Necessary preparation：Read chapter 2.5 and to 2.7 in the textbook.
4. Basic logical operations and logical expression – discuss Boolean algebra and logical operations as an introduction to the numerical basics of computer computation. Explain the basic logical operations, logical AND, logical OR, and logical NOT. Necessary preparation: Read from 3.1 to 3.4 in the textbook.
5. Characteristics of logical algebra – discuss the axioms of logical algebra, and go over the theorems and proofs that develop from that axiomatic system. Necessary preparation: Read chapter 3.5 in the textbook.
6. Simplification of Boolean expressions – explain the necessity of and principles behind Boolean expression simplification. Discuss simplification methods using Karnaugh maps and other means. Necessary preparation: Read from 3.6 to 3.7 in the textbook.
7. Other arithmetic operations and basic arithmetic circuits – explain logical expressions other than the most basic. Discuss logic gates used to express the basic operations – the AND, OR, and NOT circuit models and their notations. Necessary preparation: Read chapter 3.8 and 4.1 in the textbook.

8. Adder-subtractors – explain adder-subtractor circuits. Particular focus on half-adders, full-adders, and parallel adders, and their operations and circuit structures. Necessary preparation: Read chapter 4.2 in the textbook.
9. Other combinational circuits – explain combinational circuits: decoders, encoders, multiplexers and demultiplexers. Read from 4.3 to 4.8 in the textbook.
10. State transition diagrams and dynamic charts – explain the fundamental characteristics of sequential circuits used in computer control circuits. Necessary preparation: Read chapter 5.1in the textbook.
11. Flip-flops (state transition tables and characteristic equations) – explain the principles, characteristics and characteristics of sequential circuits used in various flip-flops. Necessary preparation: Read chapter 5.2 in the textbook.
12. Flip-flop transformation– show how various flip-flops can mutually transform and discuss the principles and methods. Necessary preparation: Reread chapter 5.2 in the textbook.
13. Counters – discuss methods of designing the sequential circuits known as counters by combining flip-flops and combinational circuits. Necessary preparation: Read from 3.6 to 3.7 in the textbook.
14. Specific pattern detection – discuss methods of design the sequential circuits known as specific pattern detection circuits by combining flip-flops and combinational circuits. Necessary preparation: Read chapter 5.5 in the textbook.
15. Register and calculator behavior – explain latches, shift registers, etc. as applications of sequential circuits. Necessary preparation: Read chapter 5.6 in the textbook.
16. Final exam

[Keywords] hardware, Boolean algebra, combinational circuit, sequential circuit
[Textbooks and Reference Books] ``Basics for Computer Engineering,'' Yoshiharu SHIGEI, Kindai-kagaku-sha, 1990
[Evaluation] Students must have taken over 60 points on final exam to obtain the credits.
[Related courses] Information Processing, Computer Programming　I・II, Numreical Computation
[Remarks] This course satisfies the Department of Electrical and Electronics Engineering learning goal "(B) PragmaticSkills."

情報理論 Information Theory
[Instructor] Takashi Okamoto
[Credits] 2
[Semester]3rd year-Spring Mon 3
[Course code] T1R040001
[Room]Bldg.Eng.17- 213
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student..
[Course description] The class will cover basic mathematic issues of the information. Students will learn the quantification of the information and the mutual information and the mathematic theory of the information transfer on the channel. They also will learn the coding theory to detect and correct errors, which enables the information transfer with high reliability.
[Course objectives] To learn the basics and essence of the information theory.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand the role and importance of the information theory in science and engineering. (E-4)	1	Final exam	5 %
2	To understand the necessity and the meaning of the quantification of the information, and master its methodology. (E-3)	2, 3, 4	Final exam	10 %
3	To understand the meaning of efficient information source coding, and be able to construct actual code. (E-3)	5, 6	Final exam	20 %
4	To understand the role and importance of the channel, and master the notion of the mutual information. (E-3)	7, 8, 9	Final exam	30 %
5	To understand methods of the channel coding to address noise in the channels. (E-3)	10,11,12,13,14	Final exam	35 %

[Plans and Contents] Instructor lectures in accordance with the following plans. Students at the class are required to prepare materials that can be downloaded from the Chiba University moodle system before lecture.
1. Introduction
2. Quantification of the information
3. Characteristics of average information (entropy)
4. Markov information source
5. Information source coding
6. Specific information source coding methods
7. Channel and mutual information I
8. Channel and mutual information II
9. Channel coding
10. Error detection and correction
11. Linear code I
12. Linear code II
13. Cyclic code I
14. Cyclic code II
15. Summary and assessment of understanding
16. Exam

[Keywords] Entropy, Mutual Information, Coding, Information Source, Code, Error Detection and Correction
[Textbooks and Reference Books] Hironori Hirata: The Essence of Information Theory, Ohmsha (Textbook)

[Evaluation] Understanding degree will be checked by examinations.
[Related courses] A Basic Course in Probability Theory A Basic Course in Probability Theory, The communication engineering basic,Introduction to Communication Systems
[Course requirements] The students who learnt A Basic Course in Probability Theory A Basic Course in Probability Theory are preferable.

信号処理 Signal processing
[Instructor] Chang-Jun AHN
[Credits] 2
[Semester] 3rd year-Fall Wed 3
[Course code] T1R041001
[Room] Bldg.Eng-17- 214
[Course enrollment] 80
[Candidate] Students of faculty of Engineering.
[Course description] This lecture will introduce the basic knowledge on the signal processing necessary for realizing the systems in the wide range including audio, images, control, and communications. Particularly, students will understand difference between continuous time (analog-based) signals and discrete time (digital-based) signals, and characteristics of these signals. They will also learn the signal analyses in the frequency domains, Fourier transformation, and digital filter (FIR and IIR).
[Course objectives] Students will understand various technologies, including basic concept of the signal processing and signal analyses in the frequency domains, Fourier transformation, and a design method of the digital filters

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the basic concepts behind Nyquist sampling and anti-aliasing, which are necessary in analog/digital conversion.	1, 2	Final exam	10 %
2	Understand the basic concepts behind Fourier transforms.	3, 4, 5, 6	Report Final exam	40 %
3	Understand the basic concepts behind fast Fourier transforms and methods of reducing computation.	7, 8, 9	Final exam	10 %
4	Understand the characteristics of z-transforms, frequency characteristics using z-transforms, and the stability of discrete systems.	10, 11	Report Final exam	20 %
5	Understand the design methods and characteristics of digital filters.	12,13,14, 15	Final exam	20 %

[Plans and Contents]
1. Overview of signal processing
2. Conversion of analog and digital signal
3. Fourier series expansions 1
4. Fourier series expansions 2
5. Fourier transforms 1
6. Fourier transforms 2
7. Fast Fourier transforms
8. Convolution and difference equations
9. Frequency response and transfer functions
10. Basics of z-transforms 1
11. Basics of z-transforms 2
12. FIR filters 1
13. FIR filters
14. IIR Filters
15. Digital signal processing applications
16. Final exam

[Keywords] Sampling, Fourier transforms, Band limitation, Window function, Adaptive Filter, FIR filter, IIR filter, z transforms, Auto-correlation, Cross-correlation
[Textbooks and Reference Books]Handouts will be provided at the beginning of the course. The following references can be used for preparation.S. J.Orfanidis : Signal Processing（Prentice Hall）。IEICE Text series：Fundamentals of Digital Signal Processing（corona publishing co.）。Tatsuo Higuchi・Masayuki Kawamata：MATLAB for Digital Signal Processing（shokodo publishing co.）

[Evaluation] Students will be evaluated based upon irregular reports and the final exam, and require a total mark over 60% to pass. Students will fail the course if they miss five or more classes or miss the final exam.
[Related courses] Industrial mathematics, Basics of Communication Engineering
[Course requirements] Students must attend more than 70% of lectures (credit cannot be acquired if this requirement is not satisfied). Students should prepare before each class to gain a better understanding of the lectures.
[Remarks] A projector will be used during lectures. Materials will be handed out.

計算機工学 Advanced computer hardware
[Instructor] Tomoyoshi Shimobaba
[Credits] 2
[Semester] 3rd year-Fall Tue 2
[Course code] T1R042001
[Room] Bldg.Eng-17- 214
[Course enrollment] 50
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] The present digital circuit design mainly uses a programming language known as hardware description language (HDL) which designs large-sized digital circuits. In this lecture, it is a purpose that students will more understand the logical circuits through exercises of the digital circuit designs using the HDL, and they themselves will be able to perform more practical circuit designs
[Course objectives] The present digital circuit design mainly uses a programming language known as hardware description language (HDL) which designs large-sized digital circuits. In this lecture, it is a purpose that students will more understand the logical circuits through exercises of the digital circuit designs using the HDL, and they themselves will be able to perform more practical circuit designs

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Learn about binary, combination circuits, sequential circuits, and state transition.	1	Assessment of understanding	10 %
2	Combinational circuit design using HDL.	1, 2, 3, 4, 5	Assessment of understanding	30 %
3	Sequential circuit design using HDL.	6, 7, 8, 9	Assessment of understanding	30 %
4	Practical circuit design using HDL.	10,11,12, 13, 14	Assessment of understanding	30 %

[Plans and Contents]
1. Learn about binary, combinational circuits, and sequential circuits. HDL outline1.
2. HDL outline 2 Methods of operating HDL tools.
3. Combinational circuit design using HDL 1
4. Combinational circuit design using HDL 2
5. Combinational circuit design using HDL 3
6. Sequential circuit design using HDL 1
7. Sequential circuit design using HDL 2
8. Sequential circuit design using HDL 3
9. Sequential circuit design using HDL 4
10. Practical circuit design using HDL 1
11. Practical circuit design using HDL 2
12. Practical circuit design using HDL 3
13. Practical circuit design using HDL 4
14. Practical circuit design using HDL 5
15. Overall course outline and comprehension assessment

[Keywords] Computer, digital circuit, logical circuit, combined circuit, sequential circuit, hardware description language, HDL, VHDL
[Evaluation] Students will receive credit for receiving a mark higher than 60% in the comprehension assessment.
[Related courses] Information Processing, Programming, Numerical Analysis, Software Engineering, Algorithm Design and Analysis, Basics of Calculators, Integrated Analysis Circuits
[Course requirements] Students have preferably taken courses of Introduction to Computer hardware.
[Remarks] In order to use the HDL tools, students need access to a PC with MS Windows installed.

通信工学基礎 Introduction to Communication Systems
[Instructor] Chang-Jun AHN
[Credits] 2
[Semester] 3rd year-Spring Tue 3
[Course code] T1R044001
[Room] Bldg. Eng.17-112
[Course enrollment] 80
[Candidate] Students of faculty of Engineering
[Course description] Students learned the coding and combining method to maximize the communications capacity which was regulated by the band width and signal-to-noise ratio (SNR) in the information theory. In this lecture, outline of the communication technology will be indicated from the more hardware-like aspect, and the logical aspect which will be its platform, circuits, system structures, and various peripheral technologies which are important in configuring the communications systems will be introduced.
[Course objectives] Students will understand the logical aspect and the circuit and system structures, and various important peripheral technologies in configuring the system in the communications systems.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand the sampling theorem, and the characteristics of signal sampling and quantization.	1, 2	Final exam	10 %
2	Understand the relationship between spectra and waveform, and the relationship between frequency and time response in linear systems.	4,5,12,13,14, 15	Report, final exam	20 %
3	Gain an overall understanding of analog modulation and demodulation, and the method merits/demerits.	6, 7	Final exam	15 %
4	Gain an overall understanding of digital modulation and demodulation, and encoding and decoding, and method merits/demerits.	8, 9	Final exam	15 %
5	Understand the characteristics of white noise and the effect it has on communication quality.	10, 11	Final exam	20 %
6	Gain an overall understanding of current communication systems and how they are constructed.	13, 14, 15	Report, final exam	20 %

[Plans and Contents]
1. Introduction to communication systems
2. Analog-digital conversion (sampling and quantization)
3. Configuration of transmission lines and communication systems
4. Fourier series expansion
5. Fourier transforms
6. Analog modulation and demodulation
7. Configuration of analog communication devices
8. Digital modulation and demodulation
9. Configuration of digital communication devices
10. Noise and error rate, intersymbol interference
11. Error-correction code (convolutional code, LDPC code)
12. Multiplex communication (frequency, time, code division multiplex)
13. Spread spectrum communication methods
14. Orthogonal frequency division multiplexing 1
15. Orthogonal frequency division multiplexing
16. Final exam

[Textbooks and Reference Books] Tetsuo Takeshita,, Hideki Yoshikawa：Communications Communications engineering（Corona publishing co.）, Iwane Kimura : Introduction of Communications Communications engineering（Ohm publishing co.）Keiji Hiramatsu：Communications Communications engineering（Corona publishing co.）
[Evaluation] Students will be evaluated based upon periodic reports and the final exam, and require a total mark over 60% to pass. Students will fail the course if they miss five or more classes or miss the final exam.
[Related courses]Information Theory, Industrial Mathematics
[Course requirements] Students must attend more than 70% of lectures (credit cannot be acquired if this requirement is not satisfied). Students should prepare before each class to gain a better understanding of the lectures.

電力変換システム設計 Power Conversion System Design
[Instructor] Keiichiro Kondo
[Credits] 2
[Semester] 4th year-Spring Wed 2
[Course code] T1R046001
[Room] Bldg.Eng. 17-212
[Course enrollment]About 20
[Candidate] Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] Students will be explained about the basic issues related to the design of the rotating equipment's, transformers, and semiconductor power transformation apparatuses, and provided with rich opportunities of the exercises realistic to actual cases, so that they will master education which can be applied to the actual system formation.
[Course objectives] It is a purpose that students will master basic issues necessary for designs as an electric and electronic engineer. It is the goal of this lecture that students will understand the basic issues related to the design of the rotating equipment's, transformers, and semiconductor power transformation apparatuses, and apply the understanding to the actual designs.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Be able to understand magnetic phenomena in electrical devices. (Elec F-2, F-3, H-3)	2, 3, 4, 8	Intermediate exam	5 %
2	Understand the points that should be considered during transformer design. (Elec F-2, F-3)	3, 8, 11	Intermediate exam, report	10 %
3	Understand the points to consider in AC rotary device design (Elec F-2, F-3)	4, 5, 8	Intermediate exam	5 %
4	Understand the points to consider in semiconductor power conversion circuit design. (Elec F-2, F-3)	6, 7, 8	Intermediate exam	5 %
5	Understand the fundamental theory behind thermal design of electrical devices. (Elec F-2, F-3)	2, 8	Intermediate exam	10 %
6	Make use of knowledge related to electrical device design. Be able to undertake simple device design and learn about the philosophies common to general design. (Elec F-2, F-3)	11,12,13,14,15	Report	45 %
7	Gain the basic knowledge of standards, which play an important role in specifying the performance rating of electrical devices and in industrial product design. (Elec F-2, F-3)	1, 8	Intermediate exam	10 %
8	Learn about electrical circuit symbols and other fundamental knowledge used in drawings in the electrical engineering fields.(ELEC H-3, F-2, F-3)	10	Report	10 %

[Plans and Contents] Students will more understand the performance and structure of the electric appliances in the first part of the class, aiming to provide the lectures in which the students will also understand outline of the design operations. In the second part of the class, simple electric drawings and practical works on the design will be added in the lectures in which they will learn the practical operation.

1. Summary, specifications and standards in power conversion system design – explain the design of the various power conversion systems that support modern society, and learn about the significance of the various course points. In addition, discuss the basic points that guide electrical device design, i.e. specifications and standards design. ■ Students should download and study the materials from the specified URL.
2. What defines the functions of electrical devices: discuss temperature increase and magnetic flux saturation due to current, the value that defines electrical device functionality. Also discuss the relationship between rating and temperature increase as an important indicator in electrical equipment. ■ Review pages 1 to 10 of the textbook beforehand.

3. Transformer design: gain the knowledge regarding types and structures necessary to transformer design, undertake transformer design calculation, and engage in practical design. ■ Review the downloadable materials and text pages 11 to 16 beforehand.
4. Rotary machine design 1: understand how to determine magnetic flux through stator magnetic circuits, how to calculate required magnetomotive force calculation and winding arrangements (winding arrangements and harmonics, short-pitch winding and concentrated winding, fully-pitched winding and short-pitch winding). ■ Review the downloadable materials and text pages 52 to 53 beforehand.
5. Rotary machine design 2: explain induction and synchronization as important parts of rotor design. ■ Review the downloadable materials and text pages 98-103 to 53 beforehand.
6. Power converter circuit design 1: learn about the types, characteristics, uses, etc. used in power converter design. ■ Review the downloadable materials
7. Power converter circuit design 2: learn about current/voltage capacity, circuit loss, cooling and other points that should be considered in power converter design. ■ Review the downloadable materials
8. Review of content of classes 1 to 7: Review the previous lectures, and understand the perspective s and mutual relationship found in power converter system design. ■ Self-study of material from classes 1 to 7.
9. Intermediate exam: conduct test to assess understanding of material learned until this point.
10. Basics of electrical engineering drawing – understand symbols used in describing electrical circuits, and the basics of electrical device design drawings. ■ Review the downloadable materials
11. Practical transformer design 1: understand voltage design methods that satisfy given specifications. ■ Students should download the materials and conduct design calculations.
12. Practical transformer design 2: understand the materials and manufacture of designed transformers. ■ Students should download the materials and conduct design calculations.
13. Practical transformer design 3: deepen understanding of important points in transformer fabrication. ■ Students should download the materials and conduct design calculations.
14. Practical transformer design 4: gain a precise understanding of the meaning and methods regarding transformer design, manufacture, and evaluation results. ■ Students should download the materials and conduct design calculations.
15. Practical transformer design 5: gain a precise understanding of the meaning and methods regarding transformer design, manufacture, and evaluation results. ■ Students should download the materials and conduct design calculations.

[Keywords] rotating machine, transformer, semiconductor electricity conversion circuit

[Textbooks and Reference Books] Required textbook: University level Electronic Design (Ohm Publishing) byJutaro Takeuchi .

Further lecture materials should be downloaded from http://ps.tm.chiba-u.jp/~kkondo/a_pcdesign/a_pcdesign_top.html. Students who wish deeper understanding through self-study should contact the instructor for a further list of appropriate texts and materials.

[Evaluation] In principle, students will be evaluated out of a total of 100 marks from the midterm exam (50%) and the reports (50%).

[Related courses] Electric Matetrial, Power Electronics, ElectricalPower System

[Course requirements] In principle, students should have received credit in Electrical Energy Conversion Devices and in Power Electronics. However, students who wish to take the course who don’t meet the requirements should consult with the instructor about any unclear points.

[Remarks] Students looking to obtain an exemption from the written examination for qualification as a licensed electrical engineer must take this course. The course satisfies electrical and electronic engineering learning goals F-2, F-3, and H-3, “Specific Performance Goals”.

光エレクトロニクス Optical Electronics
[Instructor] Ken Morita
[Credits] 2
[Semester] 4th year-Spring　Tue 3
[Course code] T1R047001
[Room] Bldg.Eng 17-213
[Course enrollment] 30
[Candidate] 4th year students
[Course 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.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Classical properties of light: light propagation, polarization, reflection/transmission characteristics	1, 2,3, 4, 5, 6,	Exam, report	30%
2	Structure of matter	7, 8	Exam, report	20 %
3	Interaction of light and matter	9, 10,11, 12	Exam, report	30 %
4	Optical devices	13, 14	Exam, report	20 %

[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. Class8 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.

情報システム設計論　Design　of Educational Information Systems
[Instructor] Ito Tomoyoshi
[Credits] 2
[Semester] 4th year-Fall Mon 2
[Course code] T1R048001
[Room] Bldg.Eng- 17- 215
[Lecture code]T1R048001
[Course enrollment] The number of students that is packable in a lecture room
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] The information systems are popular in any fields in the world. Students will overview the information technology used in the modern world, and master basic knowledge to explain the mechanism of the technology, and how the technology is used.
[Course objectives]　Students will master basic knowledge on the information technology. It is a goal that the class will be preceded with the range of questions for “Fundamental Information Technology Engineer Examination” in a conscious way, and those who have taken this class will reach to the level to the acceptance criterion.

	Targets　of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Data structures and algorithms	1, 2, 3	Final exam	20 %
2	Hardware	4, 5, 6	Final exam	20 %
3	Software	7, 8, 9	Final exam	20 %
4	Network technology	10, 11, 12	Final exam	20 %
5	Database technology	13, 14, 15	Final exam	20 %

[Plans and Contents]
Gain an overall understanding of information systems at the level of the information technology engineer. Learn about the goal and target of information systems, and the details about system structures and structural elements necessary in implementing information services.
1. Data structures and algorithms
2. Data structures and algorithms
3. Data structures and algorithms
4. Hardware
5. Hardware
6. Hardware
7. Software
8. Software
9. Software
10. Network technology
11. Network technology
12. Network technology
13. Database technology
14. Database technology
15. Database technology
16. Final exam

[Keywords] Information technology engineer.
[Textbooks and Reference Books]
[Evaluation] Evaluation is given by the score of Final exams.
[Remarks] A number of students will be asked to give presentation on related items each class. Students should prepare sufficiently.

情報通信システム論　Information and Communication Systems
[Instructor] (Kato Yoichi)
[Credits] 2
[Semester] 4th year-Spring Tue 5
[Course code] T1R049001
[Room] Bldg.Eng 17-215
[Course enrollment] 40
[Candidate]Students of faculty of Engineering, other Faculties,and Specially Registered Non-Degree Student.
[Course description] New information communication systems such as mobile phones and the Internet are used for any human activities. Students will learn the network structure, the transmission method and the medium of the communication system, and the information processing technology to be used on the communication system.
[Course objectives] Students will learn the basic principles of the technology commonly used in the information communication system (for example, Fourier transformation) every time when it is needed (including the issues as review depending on the lecture history of each student).Based on this, broad subject matters, including the information volume compressed method such as audio and image, the digital transmission method such as LAN, the modern information system in which the database (DB) and web are combined, aiming to capture the full truth of the modern information communication system as much as possible. The students will also be exposed to the field of the latest technology construction through the observation of the company and the institute. In the lecture, the students will make a full use of PC to actually perform the formulation of the image, compression, and DB. For the programming, general script language known as Python will be used
[Plans and Contents]
A tour is planned at NTT's R&D Center or company. Students will know the details in class.
1. Introduction
2. Fourier transforms and the sampling theorem 1
3. Fourier transforms and the sampling theorem 2
4. Various information/communication problems 1
5. Learning Python, a general-purpose scripting language
6. Information compression techniques 1 (basics)
7. Information compression techniques 2 (basics)
8. Information compression techniques 3 (applications: image compression)
9. Digital transmission 1 (basics)
10. Digital transmission 2 (applications, look over ADSL)
11. Digital transmission 3 (IP, LAN, the internet)
12. Database and current web-based information system basics
13. Various information/communication problems 2 (Q&A)
14. Information and telecommunication system tour
15. Information and telecommunication system tour

[Keywords] information and telecommunications system, compression, analog, digital, image, light, internet, database, web, ICT
[Textbooks and Reference Books]
The course will be based upon material created by the lecturer. There is no designated textbook.
[Evaluation] Announcement in the Lecture.
[Remarks] In the Web pages of this lecture, the programs for various types of the experiments to be demonstrated by the instructors, including the image compression are available in addition to the presentation materials to be used in the lecture. Students will more understand the lecture when they operate these with their own PC.

高電圧工学 High Voltage Engineering
[Instructor] (Kazuo Watanabe)
[Credits] 2
[Semester] 4th year-Spring Mon 5
[Course code] T1R051001
[Room] Bldg.Eng- 17- 212
[Course enrollment] No limit
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student..
[Course description] The education of high voltage engineering has commemorated 100th anniversary last year; however, the basic technology has been advanced, and the applied technology has been so developed during this period that the education is still in growth phase as learning. Students will learn basics of the high voltage technology of our country at the top international level.
1. Physical phenomena unique to high voltage; 2. high voltage generating apparatus and how to use the apparatus; 3. measurement technology in electric discharge and high voltage 4. application of discharge。
[Course objectives]1. High voltage engineering is a basic learning of the insulation design which is indispensable from electron devices of nano-order to the electric devices and power equipment of mega-order. Students will learn about theories regarding discharge, insulation breakdown, generation of high voltage and the measurement technology.
2. Students will learn together that high voltage technology is a basic of the power technology supporting current comfortable life, and a technology which also contributes to an environmental problem.
[Plans and Contents]
1. Gas molecule motion in free space – Maxwell's velocity distribution, mean free path (λ), cross-section, excitation and disassociation, etc.
2. Charged particle generation and vanishing – Penning effect, collisional ionization, photoionization, thermal ionization, charged particle vanishing process, mobility, diffusion, etc.
3. Fundamental theory of gaseous discharge (Townsend theory) – process of change from dark current to spark discharge, electron avalanche, α behavior, β behavior,γ behavior, Townsend theory (spark discharge equation), etc.
4. Fundamental theory of gaseous discharge (Streamer theory) (Paschen's law).
5. Electrode geometry and discharge characteristics – uniform electric field discharge, non-uniform electric field discharge, corona discharge, electrode gap (gap length) and discharge mechanisms, etc.
6. Discharge under various boundary conditions – high-pressure discharge, vacuum discharge, electronegative gas discharge, power frequency and discharge, glow discharge, arc discharge, etc.
7. Lightning discharge and arrestors – impulse voltage, V-t curves, thundercloud formation, lightning discharge, arrestors, etc.
8. Electrical conductance and breakdown in liquid dielectrics – charged carrier generation, electrical conductance, dielectric breakdown theory, actual dielectric oil breakdown, etc.
9. Electrical conductance in solid dielectrics – charged carrier generation, charged carrier motion, etc.
10. Dielectric breakdown theory in solids – dielectric breakdown theory, electrical breakdown, thermal breakdown, medium effect, thickness effect, etc.
11. Composite dielectric discharge – voltage share, creeping discharge, contamination flashover, partial discharge, treeing, V-t characteristics (voltage-time), etc.
12. High-voltage generation – testing transformers, DC voltage generators, impulse voltage generators, etc.
13. High-voltage measurement method – static voltmeters, sphere gaps, potentiometers, multipliers, optical measurement, etc.
14. Discharge applications
15. Exam

[Textbooks and Reference Books] Textbook KONO Teruya[High Voltage Engineering],Reference Books HIDAKA Kunihiko [High Voltage Engineering] AKASAKI Masanori「Basic High Voltage Engineering」、ANDO Akira, Otake Masaaki「High Voltage Engineering」KOSAKI Masamitsu「High Voltage and Insulating Engineering」、ONODAet. 「Introduction to High Voltage and Insulation Systems」、NAKANO Yoshiei 「High Voltage Engineering」
[Evaluation] Evaluation is given by the report and score of Final exams.
[Related courses] Energy Conversion Engineering, Electrical Power Systems, Ionized Gas Theory, Basic Properties of Solid State Electronics, etc.
[Remarks] Depending on experience, credit in this course may be necessary to acquire qualification as a licensed electrical engineer.

発変電工学 Power Station and Substation Engineering
[Instructor](Mamoru Suzuki)
[Credits] 2
[Semester] 4th year-Fall Tue 2
[Course code] T1R052001
[Room] Bldg. Eng- 17- 213
[Course description] The national electric service desires revolutional changes including review of the resource structure, and the generating and transmitting power separation under the impact of the brutal accident caused by Fukushima nuclear plant occurred on march 11, 2011.A part of the thermal power generation will so increase that the environmental measure, and the energy resources securement will become a challenge more seriously in future, and this state cannot be avoided, and the technology development and introduction regarding the recyclable energy dispersed power need to hasten. Lectures regarding the latest environmental technologies based on such circumstances, related to energy use and energy issues as well as basics of hydro and thermal power generation, power system management, balancing power.
[Course objectives] Students will broadly understand the entire electric service with the generating equipment centralized

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand and gain an interest in current state of environmental issues and energy resources.	1,2	Final exam	10 %
2	Understand the principles and issues of renewable energy and distributed power supply.	3	Final exam	60%
3	Obtain knowledge of electrical power facilities and their design.	4-14	Intermediate report、Final exam	15 %
4	Understand the role of transmission grids.	15	Final exam	15 %

[Plans and Contents]
1. Introduction – discuss environmental issues, energy issues, issues around the electrical industry, the work of the electrical industry.
2. Energy resources supply & demand – discuss resource availability, production capacity, import amount, supply & demand, and future trends regarding oil, coal, natural gas, and other electricity generating energy resources.
3. Distributed power generation – discuss the principle, current state, merits and issues around distributed power generations through solar cells, fuel cells, wind power, geothermal power, etc.
4. Hydroelectric power 1 – discuss the basic points of hydroelectric power plants and civic engineering installations such as dams, intakes, water channels, and their design.
5. Hydroelectric power 2– discusses civic installations such as water cisterns and pipes and their design, and types and characteristics of waterwheels.
6. Hydroelectric power 3– discusses how to select water wheels, accessory facilities.
7. Hydroelectric power 4– discusses electrical facilities at hydroelectric power plants, including characteristics of water turbine generators.
8. Hydroelectric power 5 – discuss hydroelectric power generation planning in terms of economic efficiency.
9. Hydroelectric power 6） – discuss the essentials of constructing, operating, and maintaining hydroelectric power plants.
10. Thermal Power 1 – discuss the fundamental points of thermal power, i.e. types, characteristics, thermal efficiency, thermal cycles, etc.
11. Thermal Power 2– discusses the design philosophy behind boilers and other accessory facilities.
12. Thermal Power 3– discusses the design philosophy behind turbines and other accessory facilities.
13. Thermal Power 4– discusses electrical facilities in thermal power plants, i.e. generators, transformers, internal circuitry, etc.
14. Environmental programs – discuss the measures taken to counter soot, sulfur oxides, nitrogen oxides, carbon dioxide emitted during thermal power plant operation.
15. Electrical systems and operation – discuss electrical system construction and frequency/effective power control, voltage/reactive power control, and system operations.

[Evaluation] Evaluation method: report (mid-term) and exam (final). Evaluation standard: students will be tested upon their own understanding of the essence of hydroelectric and thermal power generation facility mechanisms and design philosophy, power system operation, distributed power principles and issues, energy resources and securing those resources.

電気法規及び電気施設管理 Laws and Management of Electrical Facilities
[Instructor]　(Yasutsune Okabe)
[Credits] 2
[Semester] 4th year-Fall Mon 4
[Course code] T1R054001
[Room] Bldg Eng.17- 215
[Course objectives] It is absolutely necessary for the students who desire to go to the strong electricity and obtain Chief Electricity Engineer's License with the vocational experiences instead of the national examination to earn credits of this subject. Students will be explained with specific cases regarding the Electricity Business Act; Electric Work Specialist Act; Electrical Appliances and Material Safety Act as the laws and regulations related to the electricity; and electrical safety regulations and energy conservation law and the relevant laws and regulations. They will learn the electrical facilities management including generation, transmission, and distribution of the power from the power generation to the distribution, with overall management of the entire electricity supply facilities for power feeding
[Plans and Contents]
1. Electrical industry legal overview and electrical power characteristics (Legal structure, including related laws, electric work definitions)
2. Electrical industry history and safety systems overseas
3. Electronics incident analysis and incident examples
4. Electricity supply and demand planning (estimating demand, analyzing demand trends)
5. Electrical power development planning (Three main laws of electrical power generation）
6. Power system construction (system operations and power supply management)
7. Electricity cost and rates (Electricity industry accounting regulations)
8. Electricity safety systems in the electricity industry
9. Electrical work planning and pre-operation voluntary inspections (various test content)
10. Safety statutes
11. Electrical facility technical standards and interpretation (Part 1)
12. Electrical facility technical standards and interpretation (Part 2）
13. Electric Work Specialist act, industry law and electrical equipment safety laws.
14. The present conditions and energy-saving law of the energy use
15. Final exam

[Textbooks and Reference Books] "DenkiShisetsuKanri to DenkiHoukiKaisetsu" (The Institute of Electrical Engineers of Japan). Handout will be distributed in every lecture. Referencebook: "Jikayou Denki Kousakubutsu Hikke" (Kanto Tohoku Sangyo Hoanbu).
[Evaluation]Evaluated will be given by Final exams.
[Remarks] Please note that the lecture will be closed on 7th of Oct. The first lecture will be started on 21th of Oct.

電波法規 Radio Laws and Regulations
[Instructor] (Kuniharu Okazaki)
[Credits] 2
[Semester] 4th year-Fall Tue 5
[Course code] T1R055001
[Room] Bldg.Eng-17- 214
[Candidate]Students of faculty of Engineering, other Faculties, and Specially Registered Non-Degree Student..
[Course description] Students will be lectured about outline of the radio communication regulations, and radio wave act as a basic law of using radio wave
[Course objectives] Operation of the radio facilities in principle requires qualifications as a radiotelephone operator, and students will be lectured with Radio Act necessary for those who desire to work on a technical job in a ratio communication operation; and broadcasting operation to obtain this qualification, the relevant regulations, International Telecommunication Convention and domestic relevant telecommunication regulations and laws
[Plans and Contents]
Class 1 – overview of current state of radio utilization. Class2 Radio Act overview Class 3 Radio station authorization I Class 4 Radio station authorization II Class5 Radio station operation Class 6 Radio station supervision Class 7 miscellaneous regulations and penal regulations Class 8telecommunication operator system, radio utilization charge system Class 9Self-adjusting verification system, registered inspector system. Class 10Implementing regulations, radio facility regulations Class 11Broadcast law Class 12Recent topics in radio waves Class 13Summary of the Radio Act, exam Class 14 Wire Telecommunications Act, Telecommunications Business Act　Class 15 ITU and world radio communication laws.

1. Radio wave characteristics, frequency allocation, current state of radio utilization application and characteristics.
2. Overview of the Radio Act legal structure, goals, and definitions.
3. The licensing systems behind establishing radio stations, including principles and procedures.
4. Simplified procedures for establishing a radio station, and stations for which licensing is unnecessary. The re-licensing system.
5. Operating principles, goals and intended use of radio stations. Radio station operations and operations in extreme cases.
6. Radio station observation – changing facilities, designation, and periodic inspections after establishing a radio system.
7. Miscellaneous regulations on facilities using high-frequency waves, designating propagation failure prevention regions, etc. Illegal radio station establishment and penalties for unauthorized changes in construction.
8. Radio operator system of qualifications, testing, operating range, etc. – radio operators which collect radio utilization fees.
9. The self-check system for radio facility operators to confirm they meet standards – the system provides for review of the abilities and methods needed to confirm whether a radio facility meets legal standards, and for registration. It also provides a framework for registered inspectors who conduct maintenance and inspections.
10. The regulations that enforce the Radio Act – the regulations that lay out the technological standards for radio facilities.
11. The Broadcast Act – discipline for broadcasters as a subset of radio station operators.
12. Summary and exam on the Radio Act.
13. Summary on the Radio Act and recent radio applications
14. The Wire Telecommunications Act and the Telecommunications Business Act
15. The International Telecommunication Union and World Telecommunications Conference Radio Regulations

[Keywords] Wireless station, Discipline, Radio Laws
[Textbooks and Reference Books] GakushuyouDenpaHoreishu, JohoTsushinShinkokai
[Evaluation] Students will be evaluated comprehensively through short essay tests based upon attendance hours and assignments, and on the result of tests with questions based upon actual testing issues
[Remarks] The first class will be held on October7th. (Tuesday)The extra class will be held on February 10th.

マルチメディアシステム論 Multimedia System
[Instructor] Akihiro Sugimoto
[Credits] 2
[Semester] 4th year-Spring　Mon 2
[Course code] T1R056001
[Room] Bldg.Eng 17- 111
[Candidate] Students of faculty of Engineering,and credited auditors.This subject will be opened from 2004 for students who desire to obtain a qualification of “Class-1 high school teacher: Information” by the electron mechanical department. Therefore, if the course applications are beyond the acceptable range, those who desire the qualification in this department will be prioritized. If it were vacant, students will be accepted in the order of Students in other departments in the own faculty; those in other faculty; and credited auditors
[Course description] Media represented by language, audio, and image is indispensable as a means to transmit information to human. In this lecture, students will be explained about the basic concept and the nature used in the media, including language medium, audio medium, image medium, and film medium supporting five senses of human as an aspect of the information collectively viewed, and a role on which the media should play.
[Course objectives] Students will master the basic concept of the information medium through broadly learning various media supporting five senses of human, and understand the nature thereof.
[Plans and Contents]
After reviewing computer mechanisms and models, give broad explanation of various media, including language, audio, images, and video.
1. What is multimedia?
2. All about computers
3. Calculator models
4. All about human perception
5. Natural language processing
6. Human voice analysis
7. Speaking with computers
8. Music as a form of media
9. Image processing
10. Character recognition and composition
11. Computer processing of diagrams and maps
12. 3D recognition
13. Graphics
14. Understanding video
15. Media and sensitivity

[Keywords] Language media, Voice media, Image media, Movie media, Information
[Evaluation] Evaluation will mainly center on the end-of-semester exam, but attendance and quizzes (conducted as necessary) will also be included.

アルゴリズムの設計と解析　Design of Algorithms and Optimization

[Instructor] (Akira Kobayashi)

[Credits] 2

[Semester] 4th year-Spring Fri 5

[Course code] T1R057001

[Room] Bldg.Eng - 17- 211

[Course objectives] Students will be lectured about the importance of the computer software, and algorithm; and the necessity of these in the world; as well as basic algorithm such as data searching, and some applied algorithm.

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Understand methods of evaluating algorithms.	2, 3, 4, 11	Exam	10 %
2	Understand and utilize basic data structures.	5, 6	Exam	20 %
3	Understand and utilize basic algorithm structures.	7,8, 9, 10	Exam	40 %
4	Understand algorithms currently used often.	11,12,13, 14	Exam	30 %

[Plans and Contents]

Orientation. Program basics. Algorithm complexity. Data search algorithms. Optimization algorithms. Algorithms for verifying letter string data. Graph algorithms. Advanced algorithms. Application algorithms.

1. Guidance
2. Flow charts
3. Programming methods
4. Computation of Algorithm
5. Data structures 1
6. Data structures2
7. Searching 1
8. Searching2
9. Sorting 1
10. Sorting2
11. Computational complexity theory
12. Applications 1 – divide and conquer method, regression method, linear programming methods, dynamic programming methods, etc.
13. Applications 2 – Fourier transforms, genetic algorithms, neural networks
14. Applications 3 – Current topics
15. Exam

[Keywords] Algorithm, Data structure, Computer programming

[Evaluation] Exams 100%

卒業研究　Undergraduate Research
[Instructor] Each teacher
[Credits] 6
[Semester] 4th yearSpring-Fall Intensive
[Course code] T1R058001
[Room] Each lab
[Course objectives] Students will learn researching methods through experiments, lectures in turn, and seminars at each research laboratory. It will be also good opportunity for them to learn about advanced research at the same time.

	Targets　of the Subject	Related Week	EvaluationMethods of attainment level	Proportion of Total Course Grade
1	Be able to write a graduation thesis on one's research theme that includes the social and technological background necessary to the research, main technical issues, solutions, results and knock-on effects, and any remaining issues.			%
2	Be able to express the title and main content of the research theme in approximately 300 words.			%
3	Be able to orally present the important point of the graduation thesis in an easy-to-understand way using PowerPoint or other means.			%
4	Be able to evaluate performance on the graduation research, and plan out an implement necessary work and review that needs to be done.			%
5	Be able to explain one's graduation thesis in terms of completed work and planned work to the advisor or other laboratory members.			%
6	Be able to write up a technical or planning paper explaining work and review completed and work and review planned for one's graduation research thesis.			%
7	Be able to evaluate a number of methods applicable to the work and review completed and work and review planned for one's graduation research thesis, and logically explain the most optimal method.			%
8	Be able to read Japanese and English literature related to one's graduation research theme, grasp an overview of the content, and make good use of that knowledge in research work and review. 9. Be able to consider the essence of technology from various perspectives, and consider the areas in which technical judgment as an engineer is necessary. 10. Through the graduation research approach, be able to clearly understand the specialist knowledge and abilities gained thus far, and recognize the necessary issues to be dealt with in any future approach.			%

[Plans and Contents] The description (research subject) depends on a student or a group with some students.　The research subject will be released at the beginning of the fiscal year by each research laboratory(education research field), and the outline will be explained at the graduate research session.　Then, the subject will be assigned to each research laboratory via desired investigations.　The purpose, method, and plan of the research in more details will be performed at the assigned research laboratory.　The research result will be summarized as a graduation thesis, and will further have to be presented at graduate research session of the electrical and electronic engineering course.
[Evaluation] A) Graduation Thesis Evaluation (max.20 marks)
1. Appropriate title and summary (English and Japanese) (H-1) 2. Structure (sections, quotes, etc.)　Are appropriately organized. (A-1) 3. Social technological background necessary to the research and issues are appropriately included

(A-1,F-1,G-1) 4. Results and achievement are clearly written for a graduation paper A-1,F-3,G-1) B) Graduation Research Presentation Evaluation (max. 30 marks) 1. The research summary (possibly the preliminary draft) key points are appropriately included (A-1) 2. Research content is comprehensibly and appropriately presented orally. (A-2, B-3) 3. Correctly understand the place and meaning of the research conducted (G-1, H-3) 4. The methods were chosen and implemented appropriately and were understood. (F-1,F-2,F-3,H-1,H-2,H-3) 5. During question and answer sessions, questions are understood and answered appropriately. A-2,F-3) 6. The knowledge and abilities in which experience was gained through the research were understood. (H-2,H-3) C　Graduation Research Evaluation (max. 50 marks)　(Will also refer to the graduate research notes, the career development report, and the concept of engineers repor 1. Can read and understand Japanese and English literature related to the research theme, and can apply it to the research report work and review. (H-1,H-2)2. Periodically explained work and review implemented and to be implemented, in comprehensible writing, and has a plan that explores the research from a sufficiently broad perspective. (A-1,F-1,F-2,F-3,H-4) 3. Had the necessary initiative and enterprise in approach issues in implementing the research, and showed ingenuity. (　F-1,F-2,F-3,H-2,H-4) 4. Be able to understand and write an appropriate graduation thesis on one's research theme that includes the social and technological background necessary to the research, main technical issues, solutions, results and knock-on effects, and any remaining issues. (A-1,B-3) 5. Through implementation of the graduation research, be able to clearly understand alone the specialist knowledge and abilities gained thus far, have the ambition to increase that knowledge, and recognize the necessary issues to be dealt with in the future (F-2,F-3,H-2,H-3,H-4) 6. From fundamental and multiple perspectives, be able to judge and consider the concept of technology and attitude an engineer should have. G-1,G-2 ◎ A)B)C) Students who don't receive a mark of at least 60% in each of A, B, and C will not pass.

[Remarks]

This course satisfiesthe learning goals, "(A) Communication abilities" (A-1) and (A-2), "(B) Practical technology" (B-3), "(C) Event observation and review" (C-3), "(F) Problem resolution ability and implementation" (F-1)-(F-3), "(G) Understand the relationship between technology and society" (G-1) and (G-2), and "(H) Determination and Self-learning Skills" (H-1)-(H-4).

技術者倫理 Engineering Ethics (Electrical and Electronic Engineering)
[Instructor] Okita Yuji
[Credits] 2
[Semester] 4th year-Spring Thu 2
[Course code] T1R059001
[Room] Bldg.Eng.17- 113
[Course enrollment]About 80
[Candidate] Students of faculty of Engineering, It is an opening of a course of Department of Electrical and Electronics Engineering, but the attendance from other department is possible when the number of students can afford.
[Course description] This subject will help students learn and think about the technology and engineering. Most students will keep involved in creating or using technologies either they get a job or go to Graduate school upon completing undergraduate course. What do students learn and think about technology and engineering? Many students do not have experiences as a full-fledged engineer. They have no experiences as researchers. They have no experiences as managerial or executive people either. However, do they jump into the world without any plans? They should experience from now. Knowing what challenges full-fledged people will encounter as a person individually, or as a person in the organization; what they think and how they will solve the challenges as knowledge, or virtually experiencing with these through case study during the period of the students will provide something meaning and fun as working people.
It is this class that students will learn with friends and instructors about these points on the engineering ethics as an axis, and improve their ability. Students will learn with many cases including the disaster of the East Japan Earthquake and the Fukushima No. 1 nuclear power plant accident. The students will be required to have a self-directives learning attitude such as investigating cases and expressing own opinions.
[Course objectives] [Purpose]Students will master ethic education necessary for working with fun and feeling of fulfillment as a specialized business worker for professional engineering. [Goal]

	Targets of the Subject	Related Week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	Comprehend issues for examples with inherent ethical problems. (Cultivate sensitivity.)	1-15	Problem reports, term report	25 %
2	Gain knowledge useful in resolution of ethical issues. (Knowledge acquisition.)	1-15	Problem reports, term report	25 %
3	Be able to come up with multiple solutions under various constraint conditions, and then use rational reasoning to choose an optimum solution. (Acquire solution design skills)	1-15	Problem reports, term report	25 %
4	Be able to gather opinions together as a team in regards to the above three items, through ways of looking at various items, listen to the opinions of others, and present one's own opinion.	1-15	Problem reports, term report	25 %

[Plans and Contents] Scenarios of the class planning and class description are as follows: However, questions and opinions of the students will be investigated every class and the description of the class planning and class description will be appropriately modified as needed. Students should bring notebooks and writing tools with them in order to prepare lecture notebooks themselves. They will be appropriately instructed to have a group discussion, home works, and a report to submit.

1. Intro to Engineering Ethics – explain what students will learn in this course. Discuss what is needed for self-study.
2. Main points of Engineering Ethics – Thinking about company activity by experiencing the learning using the example and experience the learning method of this subject in addition.
3. Main points of Engineering Ethics – Understanding the whole aspect of this subject for imaging it
4. Think of the meaning of words. It is, for example, an engineer ethic and a technical ethic, a student and a student. A student and university.

5. Think of student more learning it about an association between university education and success as the member of society. Learn what kind of existence the university is.
6. Using a textbook (engineering ethics casebook), case learning by the group discussion (The first cool).
7. Using a textbook (engineering ethics casebook), case learning by the group discussion (The summery of first cool and secound cool)
8. Using a textbook (engineering ethics casebook), case learning by the group discussion (The secound cool)
9. Using a textbook (engineering ethics casebook), case learning by the group discussion (The summery of second cool)
10. Using a textbook (engineering ethics casebook), case learning by the group discussion (The third cool)
11. Using a textbook (engineering ethics casebook), case learning by the group discussion (The summery of third cool)
12. Learning about a study and the ethic of the researcher, together with video learning
13. Learning about a study and the ethic of the researcher. Learn about compliance and corporate social responsibility.
14. Learn about laws and ethics, including laws related to intellectual property rights.

[Keywords] engineering ethics, business ethics, science and technology, engineering, design
[Textbooks and Reference Books] Engineer Ethics in Examples－engineering ethics casebook (Vol. 2) (The Institute of Electrical Engineers of Japan (IEEJ)2014.9)Supplementary material other than the example book will be handed out in class.
[Evaluation] Reports will be submitted each class on that class’s theme, and students will be evaluated on whether their argument shows understanding of the theme. Submitted homework will also be evaluated. Moreover, a final report will be submitted in the final class, and students will be evaluated on their level of understand on their responsibilities as engineers. Overall evaluation will be weighted with reports worth 50%, homework 10%, and comprehensive report worth 40%.
[Remarks] For mechatronics students, this course serves as a replacement course for “Engineering Ethics.”

先端情報産業論 Advanced Information Industry
[Instructor] (Yasushi Miyazaki) , (Hideo Miyachi), (Nobuo Takasu), (Yuji Koike), (Yuichi Chida) , (Kazuhisa Haeiwa), (Riichiro Shirota)
[Credits] 2
[Semester] 3rd,4th year-Fall Fri 3 4
[Course code] T1R060001, T1R060002
[Room] Bldg.Eng 17- 211
[Course enrollment] 80
[Course description] Students will be introduced with various advanced information carries out a lecture in an omnibus form.
[Course objectives] Students will be introduced with various advanced information handling, devices and systems used in the electric and electron engineering, so that they will know that the applications of the electric and electron engineering which they have learned to be something familiar.
[Plans and Contents]
(1) Operating principles of liquid crystal and other display devices, structure of DVDs and other optical devices, explain the mechanisms behind semi-conductor lasers, and introduce superconductor devices and nanodevices. (2) Introduce intelligent robot sensors, artificial intelligence, and pattern recognition. (3) Power electronics technology used in high-speed train cars, electric vehicles, etc. Various electronic motors and their control methods, high-performance control methods for AC motors. Introduce energy issues and recent thermal power plant technology, etc.

1. Hideo Miyachi: Outline of Japanese space development and artificial satellite systems (2) Artificial satellite attitude control (3) Artificial satellite attitude estimation
2. Hideo Miyachi: (Held on same day as third class)
3. Hideo Miyachi: Explain visualization and stereoscopic view through numerically simulated CG
4. Hideo Miyachi: (Held on same day as third class)
5. Nobuo Takasu: Discuss energy and environmental issues, and issues and new technologies in the electrical industry (power generation, energy transmission, power systems, and electrical utilization).
6. Nobuo Takasu: Discuss energy and environmental issues, and issues and new technologies in the electrical industry (power generation, energy transmission, power systems, and electrical utilization).
7. Yuji Koike: Actual active control technologies used in heavy structures 1 – basics of control technology: understand vibration control device examples; look over every day vibrational phenomena, the objectives, principles, and structures of control devices used in high rises.
8. Yuji Koike: Actual vibration control devices – from vibration control devices used in actual buildings, learn about the various technologies used in design and performance testing.
9. Yuji Koike: Applications of vibration technology, new methods – learn about active vibration technology applications and new methods.
10. Yuichi Chida: Summary of medical diagnostic imaging devices (overview)
11. Yuichi Chida: (Held on same day as tenth class)
12. Kazuhisa Haeiwa: Explain the basics of computer simulation of EM waves, living organisms, celestial objects and the acceleration of GPU numerical computation born out of computer graphics technology.
13. Kazuhisa Haeiwa: (Held on same day as twelfth class)
14. Riichiro Shirota: History of semi-conductor memory (SRAM⇒DRAM; volatile memory, EPROM ⇒ Flash; non-volatile memory) (2) Outline of non-volatile memory (memory that saves information even when power is cut) (3) Outline of NAND Flash memory (memory technology and its applications) (4) Flash – a number of points regarding reliability.
15. Riichiro Shirota: (Held on same day as fourteenth class)

[Keywords] Information Industry, Advanced electronic device, Superconductive device, Nano device, AC motor, Inverter, Vector control.
[Evaluation] Students will be evaluated by reports and written exams.
[Remarks] Classes are set to be held on Fridays during third and fourth periods, but the time will change each time so please take sufficient care. The schedule may change again in the future, so be sure to check the syllabus regularly.

プログラミングおよび実習　Programming with Exercise
[Instructor] Tomoyoshi Shimobaba, Takashi Kakue
[Credits] 3
[Semester] 1st year-Fall Fri 4
[Course code] T1R061001, T1R061002
[Room] 5F information processing room at Engineering Research Building
[Course enrollment] 81
[Course description] To understand operation of a computer and basics of a computer operation and a computer programming through mastering an introductory description of a programming language C
To understand algorithm which is an important concept with any type of a language irrespectively, and basics of the data structure
[Course objectives] A computer program (source code) is, in a way, a type of "writing skill" which is created by human as well as a means to implement various software's.
In this class, students will understand basics of the programming, and basics of a computer operation through mastering C language developed as a main development language for UNIX.　The classes will be executed both in a normal lecture style and in a practical lecture style.

	Targets of the subject	Related week	Evaluation Methods of attainment level	Proportion of Total Course Grade
1	To understand an operating principals of a computer software (EB-2)	1, 2, 3, 4	practice・final exam	20%
2	To understand correctly concepts of internal expressions, variables, arrangement and functions (EB-2)	2, 5, 6, 7	practice・final exam	20 %
3	To express a problem as a program (EB-2)	2, 3, 4, 5, 6, 8	practice・final exam	20 %
4	To understand a concept of a pointer (EB-2)	5,6,9,10, 11	practice・final exam	20 %
5	To enable programming more applicatively (EB-2)	12, 13	practice・final exam	20 %

[Plans and Contents]
1. 1C Program components.
2. Program control/branching
3. Models
4. Calculation-1
5. Calculation-2
6. Basic materials
7. Function form macro, a recurrence summons, input and output and character code
8. Character string-1
9. Character string-2
10. Pointer-1
11. Pointer -2
12. Structure-1
13. Structure
14. File operation
15. Course review and understanding check

[Evaluation] Evaluated by Final exam and submitted assignment. Evaluate ration is as following: final exam 60%, and submitted assignment40%.

工業技術概論 Introduction to Industrial Technologies
[Instructor] Yun Lu
[Credits] 2
[Semester] Spring-Mon 5
[Course code] T1Z05400
[Room] Bldg.Eng.17-111
[Course requirements] Lectures
[Candidate] Students of faculty of Engineering,Other Faculties.
[Course 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.
[Course 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）