SYLLABUS *2012*

[D] Electrical and Electronic Engineering

Kyoto University, Faculty of Engineering

[D] Electrical and Electronic Engineering

Electrical and Electronic Engineering

60740

Introduction to Electrical and Electronic Engineering

電気電子工学概論

【Code】60740 【Course Year】1st year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2 【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】All

【Course Description】By understanding the activities conducted in the laboratories that belong to the Electrical and Electronic Engineering Course, the students learn what is the electrical and electronic engineering. Except a few times in the beginning of this course, the students will investigate the activities in the lab and have a presentation of their investigations. The students are expected to deeply understand the activities by actively investigating them by themselves and by explaining the results to other students. The students are also expected to make acquaintance with teachers and senior students (in the final year, and in master or PhD course) in the lab, and to recognize that it is essential to understand the contents lectured in the basic courses that they will learn in the first and second year, thorough the investigation of the lab and special lectures. The class will be usually conducted every two weeks and continue for two lecture-units in each lecture day. The class number of times in the table below shows the number of the lecture days.

【Grading】The grading is conducted by evaluation of various points, including the attendances at the lectures, the visit to the laboratories, and the presentation; the scores of the report; the score of the presentation.

【Course Goals】The goal of this lecture is that the students view how he or she will develop the field of the electric and electronic engineering and simultaneously how they develop their faculties in the field. For this purpose, the students will make teams, and each team will investigate the activity of a laboratory that belong to the Electric and Electronic Engineering Course. The teams cover all of the labs, and the students will share the results of their investigations through the presentation. Then, they will acquire an overview of the field of the electric and electronic engineering.

【Course Topics】

Theme	Class number of times	Description
Overview	2	A overview of the education that will be provided in the Electric and Electronic Engineering Course is lectured. After an introduction of how to proceed this course, the teams for investigation of each laboratory are announced.
Visiting of laboratories	2	Each team visits the assigned laboratory that belongs to the Electric and Electronic Engineering Course, and investigates the activities in the lab.
Preparation of presentation	2	The students prepare a poster presentation to introduce the activities in the laboratory that they visit and investigate.
Presentation	1	Each team performs a poster presentation. The students learn the activities in the laboratories that belong to the Electric and Electronic Engineering Course from the poster presentations of the other teams.

【Textbook】The materials will be distributed.

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】There is a possibility that some parts of the lectures would be removed or some new lectures would be additionally included, according to the total class number of times.

60630

Fundamentals of Circuit Theory

電気回路基礎論

【Code】60630 【Course Year】1st year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
DC circuit	3	
Differential equation of circuit	5	
AC circuit	4	
two-port circuit	2	
academic achievement test	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60030

Electric and Electronic Circuits

電気電子回路

【Code】60030 【Course Year】1st year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Basic Three Phase Circuits	2	
Passive Circuit Analysis	4	
Circuit Equations	2	
Active Circuit Analysis	3	
Frequency Characteristics of Electronic Circuits	2	
Basic Semiconductor Devices and Switching	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

22017

Information Processing Basics

基礎情報処理

【Code】22017 【Course Year】1st year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2-3	
	2	
	2	
	2	
	4-3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

230111

Exercises in Information Processing Basics

基礎情報処理演習

【Code】230111 【Course Year】1st year 【Term】2nd term 【Class day & Period】 【Location】

【Credits】1 【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】

【Instructor】Shigeyuki Oba, Daisuke Kawahara, Yuji Nakamura

【Course Description】In this course we will exercise the basic usage of UNIX-like OS and basic techniques of report writing with LaTeX. Short tasks and reports will be required in each class. A short test will be held during the term.

【Grading】Reports, short tests, and attendance records will be taken into account.

【Course Goals】This course aims to develop computer usage literacy for student-life in Kyoto university.

【Course Topics】

Theme	Class number of times	Description
An introduction to UNIX OS	2	Basic concepts on operating systems, UNIX, and network security will be explained. Also, operations for X-windows system will be demonstrated
Basic usage of UNIX OS	2	Basic usage of the file-system and command shell will be exercised.
Emacs	1	Basic usage of emacs editor will be exercised.
LaTeX	2	Basic techniques of report preparation based on LaTeX will be acquired.
Figures and graphs	2	Basic usage of gnuplot, tgif, and xv for preparing figures and graphs, and the usage of them in the LaTeX document will be acquired.
File-formats	1	Basic techniques of file-format transformation will be acquired.
Exercise	4	

【Textbook】Text for Exercises in Information Processing Basics in Japanese; available in Kyoto-university Co-op shop .

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60100

Electronic Circuits

電子回路

【Code】60100 【Course Year】2nd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2
【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Kazuhiko Sugiyama, Masao Kitano
【Course Description】Following the lecture of fundamentals of active device circuits in the course "Electric and Electronic Circuits", modeling of active devises, fundamentals of transistor circuits, various amplifier circuits, negative feedback in circuits, operational amplifiers, and oscillators are lectured. Nonlinear circuits, power supplies, and noise would be included in the course, when the lecture time remains.
【Grading】Examination and reports. More details are opened in the URL of this lecture.
【Course Goals】The goal of this course is to acquire the fundamentals of electronic circuits. Starting with understanding of a fundamental concept of electronic circuits i.e., modeling of active devices, the lecture based on the fundamental concept proceeds step by step to understand electric circuits. In this style, the lecturer wants to give the students an ability to understand the principles of more complicated circuits by application of deep understanding the fundamentals. The main targets to be understood are the circuits with bipolar transistors and operational amplifiers, as well as the fundamental concepts.
【Course Topics】

Theme	Class number of times	Description
Modeling of active devices	3	The essential concepts in the electronic circuit are lectured in order to treat active devices in the electric circuit theory. The concepts are the controlled source and the linearization. The decoupling between the bias and the signal, another important concept, is lectured.
Fundamentals of transistor circuits	3	The characteristics of the basic bipolar-transistor circuits of three different common references are lectured based on the operation principle of the bipolar transistor. The biasing circuits are lectured with somewhat practical circuits.
Various amplifier circuits	3	Several power amplifier circuits are lectured as we focus on their power efficiencies. DC amplifier circuits are lectured as we bear in mind that they are applied in operational amplifiers.
Operational amplifiers	2	The concept and advantages of the negative feedback circuit are lectured, and an important concept in the operational amplifier, the virtual short, is explained. The linear operational circuits such as integrator and differential circuits, and nonlinear operational circuits such as logarithmic and exponential amplifiers are introduced.
Oscilators	2	The principle of the oscillator circuit is lectured as a concept of the positive feedback. Various oscillator circuits are introduced with their characteristics.
Others	1~2	If we have a more lecture time, nonlinear circuits of multiplier and modulation/demodulation circuits, power supplies for electronic circuits, and the noise in electronic circuits will be lectured.
Examination	1	

【Textbook】M. Kitano, Fundamentals of Electronic Circuits (Reimei Publishing, Kyoto, 2008)
【Textbook(supplemental)】In addition to Japanese books, Tietze and Schenk: Electronic Circuits (Splinger) ; Hayes and Horowitz: Student Manual for the Art of Electronics (Cambridge)
【Prerequisite(s)】"Electric and Electronic Circuit (60030)" and "Fundamentals of Circuit Theory (60630)". (The lecturer recommends moderate understanding of fundamentals of electric circuit as the minimum prerequisites in order to achieve this course.)
【Web Sites】Link to the homepage of this course is here; (https://www.t.kyoto-u.ac.jp/lecturenotes/fe/d/60100/outline) Sorry for Japanese version only.
【Additional Information】The topics will be selected owing to limit of lecture time. The students should prepare "Bar Cover (http://www.kuee.kyoto-u.ac.jp/barcover/)" by themselves, used as a title page of each report. The homepage of this course is located in the "page of lecture materials" in the homepage of the faculty of engineering (https://www.t.kyoto-u.ac.jp/lecturenotes).

60750

Electrical and Electronic Engineering Practice A

電気電子工学実験A

【Code】60750 【Course Year】2nd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-2	
	3-4	
	3	
	6	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60760

Electrical and Electronic Engineering Practice B

電気電子工学実験 B

【Code】60760 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	4	
	4	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60620

Exercise of Computer Programming in Electrical and Electronic Engineering

電気電子プログラミング及演習

【Code】60620 【Course Year】2nd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Seminar 【Language】

【Instructor】Takashi Mastuyama, Sadao Kurohashi, Megumi Nakao, Shohei Nobuhara

【Course Description】This course is aimed at learning programming in C, one of the most popular procedural programming languages in practice. The topics include: fundamental concept of programming, various data structures and control flows, practical skills on using compilers and debuggers.

【Grading】(1) weekly reports, (2) a final project, and (3) an interview on the final project.

【Course Goals】To understand the fundamental concept of programming, data structures, and control flows as well as to learn practical skills on using compilers and debuggers.

【Course Topics】

Theme	Class number of times	Description
Introduction	1	Introduction of the importance and contributions of computer programming, followed by some instructions on weekly reports and a final project.
Prerequisites of Programming	3	Usages of C compilers and debuggers. Basic knowledge in C such as operators, data types and their representations inside the computer, control flows.
Basic Programming	4	Arrays, multi-dimensional arrays, functions, scopes, bit-operations, recursive calls.
Advanced Programming	3	Strings in C and their representations inside the computer, pointers, structures, file I/Os.
Final Project	4	A final project of this year.

【Textbook】Bohyoh Shibata: "Meikai C Gengo Nyuumon-hen (in Japanese)" (Softbank Creative)

【Textbook(supplemental)】Chinese version and Korean version of the textbook are available.

【Prerequisite(s)】"Information Processing Basics" and "Exercises in Information Processing Basics" (basic skills on using UNIX system)

【Web Sites】WebCT: https://cms.ecs.kyoto-u.ac.jp/webct/logon/44721729021
FAQ: http://vision.kuee.kyoto-u.ac.jp/lecture/cpro/

【Additional Information】You can use your own laptop PC for weekly reports and the final project. Please bring your laptop PC at the 1st week of the course. TAs will help you to setup programming environment and wifi connection.

61020

Mathematics for Electrical and Electronic Engineering 1

電気電子数学 1

【Code】61020 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】English

【Instructor】Yoshiharu Omura and Shinji Doi

【Course Description】We study properties of eigenfunctions, such as trigonometric functions, Bessel functions, Legendre functions as solutions of linear differential equations, which appear in various subjects of electric and electronic engineering such as electromagnetics, plasma physics, and quantum mechanics. As applications of these eigenfunctions, we also study Fourier series, Fourier transform, and Laplace transform.

【Grading】Reports (12times) and a term examination with the textbook

【Course Goals】We learn mathematical methods to describe spatial and temporal evolutions of various physical phenomena.

【Course Topics】

Theme	Class number of times	Description
Classification of Partial Differential Equations	2	Partial Differential Equations (PDE) : Laplace, Helmholtz, and diffusion equations; elliptic, hyperbolic, and parabolic types of 2nd order PDE.; derivation of Ordinary Differential Equations (ODE) from PDE by separation of variables
Ordinary Differential Equations	2	Series solutions by Frobenius' method; trigonometric, Bessel, and Legendre functions. Singular points for ODE; Wronskian; linear indepedence of solutions; second solution
Sturn-Liouville Theory	1	Self-ajoint ODE; Hermitian operator; Sturm-Liouville theory
Green's Function Method	1	Green's function method to solve nonhomogeneous equations.
Bessel Functions	2	MATLAB Demonstration (vibrating membrane, EM wave radiation), generating function, Bessel series; application to frequency modulation. Hankel functions; 3D Helmholtz equation in spherical coordinates, spherical Bessel functions
Legendre Functions	1	Legendre functions; generating functions; boundary value problems; associated Legendre polynomials.
Fourier Series	1	Properties of Fourier Series, Gibbs Phenomenon
Fourier Transform	2	Fourier integral, Fourier transforms of Gausian and derivatives, Dirac delta function, Solutions of wave equation and diffusion equation
Laplace Transform	2	Laplace transform, inverse Laplace transform, initial value problems of ODE

【Textbook】Mathematical Methods for Physicists, Sixth Edition, Arfken & Weber

【Textbook(supplemental)】

【Prerequisite(s)】Calculus, Vector Analysis, Functions of Complex Variable, and English comprehension of the level of VOA Special English

【Web Sites】

【Additional Information】Lectures are given in English.

60080

Electromagnetic Theory 1

電磁気学 1

【Code】60080 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Matsuo

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2 ～ 3	
	2 ～ 3	
	5 ～ 6	
	3 ～ 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60120

Logic Circuits

論理回路

【Code】60120 【Course Year】2nd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】This lecture covers analysis and design of logic circuits that form a basis of digital circuits such as processors. First, Boolean algebra, logic function and its minimization are explained. Then, analysis and design of combinational and sequential circuits are covered. Finally, arithmetic circuits for binary numbers are discussed.

【Grading】The level of achievement toward the goal of this lecture will be examined by a regular exam.

【Course Goals】To obtain basic knowledge that enables the analysis and design of small-scale logic circuits both for combinational and sequential operations

【Course Topics】

Theme	Class number of times	Description
Basics of logic functions	2	Digital circuits and logic circus, number systems, Boolean algebra, logic functions, and logical expressions are covered.
Logic minimization	4	Methods for logic minimization using Boolean cubes and Karnaugh maps, Quine-McCluskey method, properties of logic functions are explained.
Combinational circuit	2	Logic gates, analysis and design of combinatorial circuits, representative combinational circuits are discussed.
Sequential circuit	5	Operation and expression of sequential circuits, organization and operation of flip-flops, analysis and design of sequential circuits, synchronous counters and registers are explained.
Arithmetic circuit	2	The effect of delay and hazard in logic circuits are explained. Methods for binary addition and subtraction, organization and operation of binary adders are discussed. The level of understanding will be confirmed.

【Textbook】Naofumi Takagi, Logic Circuits, Shoukou-dou.

【Textbook(supplemental)】Teruhiko Yamada, Theory of Logic Circuits, Morikita Publishing .
Keikichi Tamaru, Basics of Logic Circuits, Kougaku-Tosho .

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60160

Computer Architecture Basics

計算機工学

【Code】60160 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	4	
	2	
	2	
	4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60130

Information Theory

情報理論

【Code】60130 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	2	
	5	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60150

Fundamentals of Electron Physics and Devices

物性・デバイス基礎論

【Code】60150 【Course Year】2nd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】Tsunenobu Kimoto, Jun Suda

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Quantum mechnics	4-5	
Statistics	3-4	
Solid state physics	2-3	
Electrons in solids	3-4	

【Textbook】Tanaka Tetsuro: Busseikougaku no kiso (Asakura Shoten)

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60401

Semiconductor Engineering

半導体工学

【Code】60401 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】Tsunenobu Kimoto, Jun Suda

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Introduction to semiconductor engineering	1	
Semiconductor physics	4-5	
Theory of pn junctions	3-4	
Transistors	3-4	
Photovoltaics	1	

【Textbook】Hiroyuki Matsunami: Handoutai kougaku (Shoukoudou)

【Textbook(supplemental)】WILEY S. M. Sze, Kwok K. NG ""Physics of Semiconductor Devices"" .

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61010

Electric and Electronic Measurement

電気電子計測

【Code】61010 【Course Year】2nd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	5 ～ 6	
	1 ～ 2	
	2 ～ 3	
	2 ～ 3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60770

Electrical and Electronic Engineering Advanced Practice A

電気電子工学実習 A

【Code】60770 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60780

Electrical and Electronic Engineering Advanced Practice B

電気電子工学実習 B

【Code】60780 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Exercise 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	3	
	3	
	6	
	6	
	6	
	6	
	3-	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60800

Computational Methods and Exercise in Electrical and Electronic Engineering

電気電子計算工学及演習

【Code】60800 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】3

【Restriction】No Restriction 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】Grading will be made based on reports, interview, etc.

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1 ～ 2	
	2 ～ 3	
	2 ～ 3	
	2 ～ 3	
	2 ～ 3	
	2 ～ 3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

90302

Graph Theory
グラフ理論

【Code】90302 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
What are graphs?	2 〜 3	
Shortest path problems	1	
Coloring problems	2	
Maximum flow problems	1	
Np-complete problems	1 〜 2	
The maximum matching problems	1	
Connectivity of graphs	1 〜 2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60220

Electric Circuits

電気回路

【Code】60220 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
Distributed and lumped circuit	1	
Transient analysis	5	
AC analysis	3	
Transient analysis of lumped circuit	3	
synthesis of circuit	2	
academic achievement test	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60090

Electromagnetic Theory 2

電磁気学 2

【Code】60090 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Matsuo, Amemiya

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	2 ～ 3	
	3 ～ 4	
	3 ～ 4	
	1 ～ 2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61050

Electric Machinerys Fundamenntals

電気機器基礎論

【Code】61050 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61030

Mathematics for Electrical and Electronic Engineering 2

電気電子数学 2

【Code】61030 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3-4	
	2-3	
	2-3	
	2-4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60600

Digital Circuits

ディジタル回路

【Code】60600 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】This lecture covers basics of digital circuits. First, fundamental properties of digital signals such as frequency characteristics, transmission and shaping of digital signals will be explained. Next, switching operation of semiconductor devices such as diodes, bipolar transistors and MOS transistors will be examined. Finally, circuit structure and performance of logic gates and memories for digital integrated circuits will be discussed.

【Grading】The level of achievement toward the goal of this lecture will be examined by a regular exam.

【Course Goals】To understand basic properties of digital signals and linearized circuits. To understand operating principles, circuit performance, and design method of logic gates and memories.

【Course Topics】

Theme	Class number of times	Description
Basic properties of digital signals	2	Frequency spectrum of digital signals and step response of linearized circuit will be explained.
Transmission of digital signals	2	Signal transfer characteristics of loss-less transmission lines will be explained. Lossy transmission lines will also be covered.
Switching characteristics of semiconductor devices	3	DC and transient characteristics of pn junction diodes, bipolar transistors, MOS transistors will be explained.
Waveform shaping of digital signals	1	Waveform shaping circuits such as a clipper, limiter, and Schmitt-trigger circuits will be explained.
Bipolar digital circuits	2	Basic logic gates using bipolar transistors are explained. First, DC and transient characteristics of an bipolar inverter circuit will be analyzed. Next, circuit configuration, operating principle and circuit performance of an ECL gate will be discussed.
MOS digital circuits	4	Basic logic gates using MOS transistors are explained. Circuit configuration, operating principle and circuit performance of a complementary logic gate, a complex logic gate, and a dynamic logic gate will be discussed.
MOS memory circuits	1	Circuit configuration of ROM and RAM will be explained. The level of understanding will be confirmed.

【Textbook】Hand-outs will be provided.

【Textbook(supplemental)】

【Prerequisite(s)】Semiconductor Engineering, Logic Circuits, Electronic Circuits

【Web Sites】

【Additional Information】

60260

Control Engineering

自動制御工学

【Code】60260 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】T. Hagiwara, E. Furutani

【Course Description】This course covers a basic theory of feedback control for linear continuous-time systems in the frequency domain. The fundamentals of control systems are lectured on through such concepts as the Laplace transformation, transfer functions, block diagrams, transient responses, frequency responses, and stability criteria. The course proceeds in parallel to the contents of Chapters 1 through 4 and the former half of Chapter 5 of the textbook. The stress of the lecture, however, is placed on the theoretical framework, the basic concepts, and their interrelations. Hence some topics are left to the spontaneous studies of the class members, who are also supposed to work on assignments to have better understanding.

【Grading】The assignments are only for motivating review; the grading will be based on the exam.

【Course Goals】To understand the basic treatment of linear feedback systems in the frequency domain, particularly the Laplace transformation and its role, the transient responses, stability and performance evaluation of feedback systems, frequency responses, as well as their relations.

【Course Topics】

Theme	Class number of times	Description
Feedback systems and the Laplace transformation	4 ～ 5	Fundamental notions for feedback systems, history and roles of control technologies, the Laplace transformation as a key tool for dealing with feedback control systems, and transfer functions.
Block diagrams and feedback control systems	3 ～ 4	Block diagrams and their equivalent transformations, the performance of feedback control systems and its evaluation, basic properties of feedback control systems and their roles observed through the analysis of step responses of simple examples.
Transient responses and stability of systems	1 ～ 2	Transient responses of systems and algebraic stability criteria of feedback systems.
Frequency responses	4 ～ 5	Frequency responses and their representation such as the vector loci and the Bode diagrams, manipulations of Bode diagrams, the Nyquist stability criterion, and stability margins.

【Textbook】荒木光彦：古典制御理論 [基礎編] (培風館)

【Textbook(supplemental)】

【Prerequisite(s)】Theory of functions in complex variables, as well as basic understanding about complex numbers.

【Web Sites】(from within the university) http://www-lab22.kuee.kyoto-u.ac.jp/~hagiwara/ku/AC/

【Additional Information】The contents of the lecture and their order are subject to changes depending on the situation each year.

60270

Digital Control

ディジタル制御

【Code】60270 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】T. Hagiwara, Y. Ebihara

【Course Description】This course covers a basic theory of digital control systems, based on the understanding on "Control Engineering." The treatment of discrete-time signals and linear discrete-time systems in the frequency domain is first introduced through the z-transformation and pulse transfer functions. Digital compensators as well as their programs and frequency responses, the stability and steady-state errors of closed-loop feedback systems, sampling period selection and anti-aliasing filters are then lectured on. The class members are supposed to understand the fundamental treatment of digital control systems through such concepts, who are also supposed to work on assignments about computational techniques to have better understanding.

【Grading】The assignments are only for motivating review; the grading will be based on the exam.

【Course Goals】To understand the basic treatment of digital control systems including their components and the associated difficulties and measures, particularly the z-transformation and its role, the discretization of controlled objects, the similarity to and differences from the analysis of continuous-time control systems, as well as aliasing.

【Course Topics】

Theme	Class number of times	Description
Fundamentals of digital control and the z-transformation	4 〜 5	The fundamental structure of digital control systems and the associated issues, the z-transformation as a key tool for dealing with digital control systems, the frequency-domain interpretation of samplers, and aliasing.
Pulse transfer functions, frequency response, and digital compensators	4 〜 5	Basic components such as hold circuits and pulse transfer functions, discretization of controlled objects, the pulse transfer functions and programs of digital compensators, transient responses of discrete-time systems, stability and frequency responses, and basic digital compensators.
Closed-loop digital control systems	5 〜 6	Analysis of digital control systems with pulse transfer functions through the discretization of the controlled object and disturbances, the stability, stability criteria and steady-state errors of closed-loop systems, basic standpoint for the disturbance rejection in digital control systems, sampling period selection and anti-aliasing filters.

【Textbook】荒木光彦：ディジタル制御理論入門 (朝倉書店)

【Textbook(supplemental)】

【Prerequisite(s)】"Control Engineering", "Exercise of Computer Programming in Electrical and Electronic Engineering" (basic understanding about programming)

【Web Sites】(from within the university) http://www-lab22.kuee.kyoto-u.ac.jp/~hagiwara/ku/DC/

【Additional Information】The contents of the lecture and their order are subject to changes depending on the situation each year.

60660

System Optimization

システム最適化

【Code】60660 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】The course deals with mathematical methods of system optimization for linear programming and nonlinear programming problems. It covers such topics as the formulation of optimization problem, solution and analysis methods of linear programming problems, optimality conditions and solution methods of nonlinear programming problems.

【Grading】The assignments are only for understanding; the rating will be based on an exam.

【Course Goals】To understand fundamentals of linear programming and nonlinear programming: the simplex method, duality, locally and globally optimal solution, convex space and convex functions, optimality conditions for nonlinear programming problems, and basic solution methods.

【Course Topics】

Theme	Class number of times	Description
Optimization problems	1	optimality, overview and classification of optimization problems, mathematical preliminary
Linear programming and simplex method	7-8	definition of linear programming problems, standard form, simplex method and simplex tableau, duality, dual problems, duality theorem, dual simplex method, and sensitivity analysis
Nonlinear programming problems	1	definition of nonlinear programming problems, locally optimal solution and globally optimal solution, convex space and convex function
Solution methods for nonlinear programming problems without constraints	2-3	optimality conditions for nonlinear programming problems without constraints, steepest descent method, conjugate gradient method, Newton method, and quasi-Newton method
Solution methods for nonlinear programming problems with constraints	3-4	optimality conditions for nonlinear programming problems with constraints, Lagrange function, duality, saddle point theorem, penalty function method, and sequential quadratic programming method

【Textbook】H. Tamaki (ed.): System Optimization (in Japanese), Ohm-sha, 2005 .

【Textbook(supplemental)】M. Fukushima: Introduction to Mathematical Programming (in Japanese), Asakura, 1996 .

【Prerequisite(s)】linear algebra and analytics

【Web Sites】http://turbine.kuee.kyoto-u.ac.jp/~furutani/system-optimization/

【Additional Information】The contents of the lecture and their order are subject to changes depending on the situation each year.

61060

Applied Electric Machinery

応用電気機器

【Code】61060 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Taketsune Nakamura

【Course Description】This lecture will explain principles and concepts of electric machineries used in the fields of our living and industrial applications. Especially, detailed explanation will be made for variable speed control of the rotating machines and re-generation method. Recent trends for the developments of the electric machineries such as ones for the electric vehicle and the wind turbine are also to be outlined.

【Grading】Evaluated by means of the examination. Imposed drills at the lecture and reports may also be considered for the evaluation.

【Course Goals】Understand fundamentals of designs, kinetic characteristics, coordinate transform as well as concept of variable speed control and drive-control method of rotating machineries. Also, understand basic concepts on recent trends of the developments.

【Course Topics】

Theme	Class number of times	Description
Concept of output power and fundamental aspects of design in electric machineries	2-3	Discuss the relationship among output power, rotating speed, pole number, electric loading and magnetic loading in electric machineries. Also, concept of temporal rating and that of object oriented design are also to be explained.
load characteristics and kinetic characteristics	1-2	Discuss the load characteristics, kinetic characteristics, etc. of the rotating machineries are explained. Examples of visulalized simulation results may also be shown for the aid of easier understanding.
Principle of variable speed control of rotating machineries	6-8	Based upon concrete examples, necessity for the variable speed control of the rotating machineries is discussed. And then, fundamental equations of respective rotating machines, method of coordinate transform for the expression of dynamic characteristics are explained. Further, basic concept and fundamental principle of the variable speed control is described.
Power conversion for drive of rotating machines	1-2	Power conversion method for the realization of variable speed control is explained.
Permanent magnet rotating machines	1	Permanent magnet rorating machine, which is one of the most major motors, is explained from the point of view of its rotating principle as well as characteristics.
Trends of new electric machineries	1-2	Trends of developments of new rotating machineries, e.g., electric (hybrid) automobile, linear motor, wind turbine, etc., are outlined. Also, concept and meaning of re-generation is explained.

【Textbook】Tokai Kim, "Modern electric machinery" Denki-gakkai

【Textbook(supplemental)】Takao Okada et al., "Electric machinery (2)"(second edition) Ohmsha ,
Sakutarou Nonaka, "Electric machinery (1), (2)" Morikita-shuppan

【Prerequisite(s)】Electric Circuits, Electromagnetic Theory, Power Electronics, Control Theory

【Web Sites】

【Additional Information】Documents will be distributed if necessary.

60720

Power Electronics

パワーエレクトロニクス

【Code】60720 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】Power Electronics is a filed of power conversion and system control through applications of power semiconductor devices. In class, fundamental lectures include the basic of poser conversion by switching circuit and circuit behavior in transient. The applications include the control methods of power sources and motors by conversion circuits.

【Grading】The final evaluation is decided based on examination (80%) and homework (20%).

【Course Goals】Students are expected to learn the method of power conversion and its applications based on circuit theory, switching circuit, and modulation theory. They are also requested to understand the method for achieving the functions of actuators through the control of power sources.

【Course Topics】

Theme	Class number of times	Description
Outline of power electronics	3	Introduction of power electronics and switching circuit.
dc/dc convertors	4	The dynamic behavior and characteristics of Buck and Boost converters are explained.
ac/dc convertors	3	Various conversion circuits are explained. Configurations of single phase and three phase circuits are lectured with the analysis of harmonic components of output.
allications of power electrinics	4	As the applications of power electronics, the motor drive by inverters are lectured.
Summary	1	The classes are summarized.

【Textbook】Lecture notes will be posted at the web page.

【Textbook(supplemental)】

【Prerequisite(s)】Electric circuit, Electronic circuit, Power circuit, and Electric apparatus.

【Web Sites】Lecture data are offered on kulasis.
https://www.k.kyoto-u.ac.jp/student/

【Additional Information】Students are recommended to download the note from home page.

61070

Electric Power Engineering 1

電力工学 1

【Code】61070 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60310

Electrical Discharge and Breakdown

放電工学

【Code】60310 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	3	
	6	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60320

Modulation Theory in Electrical Communication

通信基礎論

【Code】60320 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3-4	
	5-6	
	4-5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60330

Information Transmission

情報伝送工学

【Code】60330 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Susumu Yoshida

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	3	
	4	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60340

Telecommunication Networks

通信ネットワーク

【Code】60340 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3 〜 4	
	3 〜 2	
	2	
	3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61090

Radio Engineering

電波工学

【Code】61090 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】【Instructor】Toru Sato and Naoki Shinohara

【Course Description】In this class we study basics of the radio wave and antennas. We first examine the nature of the electromagnetic wave based on the wave equation derived from the Maxwell's equations. We discuss the relation between the source current distribution and the radiated wave field in terms of various antenna parameters. We further study the wave propagation, such as refraction, reflection, scattering, and diffraction. We also derive the basics of guided wave transmission from the boundary conditions of the Maxwell's equations.

【Grading】Grading is based on the regular examination, but the rating of reports may be considered as well.

【Course Goals】Understand the basic theory of the radio wave, and technology for its industrial applications.

【Course Topics】

Theme	Class number of times	Description
Nature of the radio wave	2 ～ 3	We solve the Maxwell's equation in its simplest form to show that it gives the electromagnetic wave propagating in space. Basic nature of planar wave is examined including its reflection, transmission, velocity and polarization.
Radiation and basics of antennas	4 ～ 5	We derive the radiation field from the Maxwell's equation with sources, and study its characteristics in the near and far fields. We examine the radiation from short dipole and linear antennas in terms of important parameters such as the gain, impedance, frequency characteristics, and effective area. We also study principle, structure, and basic analysis methods of various realistic antennas such as array and aperture antennas.
Radio wave propagation	2 ～ 3	We study basic issues related to various types of the radio wave propagation including the ground wave, tropospheric and ionospheric propagation, and space communication. We also discuss diffraction and scattering of the radio waves.
Guided wave transmission	4 ～ 5	We first study basic ideas related to the guided wave transmission, such as the transmission line theory and the Smith chart. We then study individual elements including coaxial line, microstrip line, rectangular waveguide, and circular waveguide, mainly focusing on their propagation modes, transmission characteristics, and loss.

【Textbook】Hasebe, 'Denpa kogaku (radio engineering),' 2nd Ed., Corona publishing, 2005 .

【Textbook(supplemental)】Balanis, 'Antenna theory,' 2nd Ed., Wiley, 1997.

【Prerequisite(s)】Knowledge of Electromagnetic theory 2 is required. Modulation Theory in Electrical Communication is recommended.

【Web Sites】

【Additional Information】

60370

Computer Software

計算機ソフトウェア

【Code】60370 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	2-3	
	3	
	2-3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61110

Embedded Computer Systems

組み込み計算機システム

【Code】61110 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】Hiroyuki Ochi and Takashi Sato

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1 ～ 2	
	2	
	2	
	2	
	2	
	1 ～ 2	
	1 ～ 2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60610

Digital Signal Processing

ディジタル信号処理

【Code】60610 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Takashi Matsuyama

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	1	
	3 〜 4	
	3 〜 4	
	2	
	3 〜 4	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60390

Solid-State Electronics

固体電子工学

【Code】60390 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】【Instructor】Susumu Noda, Takashi Asano

【Course Description】There are various devices which make use of electrons and photons in solid state (or materials). The examples are solar cells, semiconductor lasers, and transistors. These devices are indispensable for all areas of technologies, and thus regarded as brains in society. In this lecture, we explain various phenomena based on electrons and photons in solid states, where the focus is on the interaction between solid states and photons via electron transitions.

【Grading】Examination and submission of a few reports

【Course Goals】Understanding of fundamental of band structures in solid state and the related phenomena such as light absorption and amplification based on the electron transitions between valence and conduction bands.

【Course Topics】

Theme	Class number of times	Description
Overview of solid-state electronics	1	After the explanation of progress in electronics based on solid-state electronics, we show the contents of this lecture.
Fundamentals of solid-state electronics	1 ～ 2	First, we explain the method to derive band structure of solid state using Kronig-Penney model. Then, we describe various fundamental concepts in solid state, such as density of states, phonons, etc.
Photon absorption in solid state	4	We will explain the mechanism of photon absorption in solid state and derive some equations to expess the absorption quantitatively.
Amplification of light	2 ～ 3	We will explain the mechanism of optical amplification and derive some quantitative equations.
Various photonic devices	3 ～ 4	Various photonic devices based on the above discussions are given, such as solar cells, semiconductor lasers, etc.
Verification of understanding	1	We confirm whether the students can understand the above subjects.

【Textbook】Note stile

【Textbook(supplemental)】We will show some references during the lecture

【Prerequisite(s)】It is desirable to learn some related lectures such as semiconductors, fundamental of material and devices, etc.

【Web Sites】

【Additional Information】The numbers and order of course topics described above might be changed.

60810

Quantum Theory for Electrical and Electronic Engineering

電気電子工学のための量子論

【Code】60810 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60410

Plasma Engineering

プラズマ工学

【Code】60410 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2 〜 3	
	3 〜 4	
	3 〜 4	
	2 〜 3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60420

Vacuum Electronic Engineering 1

真空電子工学 1

【Code】60420 【Course Year】3rd year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】Yasuhito Gotoh

【Course Description】Fundamentals on behavior of charged particle beams (electron and ion beams) in vacuum, and also fundamentals on control of charged particle beams are given; the lecture includes nature of electrons and ions, generation of electrons, electron optics, and interaction of charged particle beams with solids.

【Grading】Grading will be done with the result of the term-end examination.

【Course Goals】The goal of the course is to understand physical basis of the phenomena related to charged particle beams, through a study of generation of charged particles, behavior in electromagnetic fields, and interaction of charged particles with solids.

【Course Topics】

Theme	Class number of times	Description
General concepts of vacuum electronic engineering	1	Concepts of electron and ion beams are given, and the advantages of these beams in various engineering are described. Finally, current status of the application of charged particle beams are given.
Formation of electron beam	4	Concept of work function which is important for electron emission from solids, and some methods to extract electrons from solid to vacuum are described.
Transport and handling of charged particle beam	6	Electron optics (electrostatic lens, magnetic lens, acceleration and deceleration), which is important to control the shape and energy of charged particles is given. Energy analyzer and mass analyzer are also explained.
Interaction of charged particles with solids	4	Fundamentals on interaction between the charged particles and the gas or solid are described, and application of the interaction will be given. Finally, achievements will be evaluated.

【Textbook】Zyunzo Ishikawa: Science and Technology of Charged Particle Beams, CORONA PUBLISHING CO., LTD. (2001)

【Textbook(supplemental)】

【Prerequisite(s)】Knowledge on electromagnetics, mechanics, and solids are requested.

【Web Sites】

【Additional Information】Bring your calculator, because tiny exercise will be in the class.

60430

Electrical and Electronic Materials

電気電子材料学

【Code】60430 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	3	
	3	
	2	
	3	
	2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60440

Fundamentals of Optical Engineering 1

光工学 1

【Code】60440 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2-3	
	3-4	
	3-4	
	3-4	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61120

Basics of Biomedical Engineering

生体工学の基礎

【Code】61120 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Kobayashi, Doi

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1-2	
	4-5	
	4	
	4	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61140

Introduction of Mechatronics

メカトロニクス入門

【Code】61140 【Course Year】3rd year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	6	
	3	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60360

Microwave Engineering

マイクロ波工学

【Code】60360 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】

【Instructor】Naoki Shinohara, Shigeo Kawasaki (JAXA)

【Course Description】Theory and applications of microwave transmittion line , microwave passive circuits, active circuits, and microwave tubes are given. Applications of thier devices and elements for mobile phones, radar and wireless power transmission are given.

【Grading】Grading will be done with the result of the term-end examination and several reports.

【Course Goals】The course goal is to understand the principle of microwaves and microwave circuits and to understand the principle of mobile phones and the other microwave applications.

【Course Topics】

Theme	Class number of times	Description
General concepts	1 ～ 2	After confirmation of Maxwell's equations and wave guide theory, general concepts of microwave enginnering are presented as introduction of the following theme.
Circuit theory of transmission line	2 ～ 3	Characteristics of microwave transmission line and circuit theory of transmission line are given. Impedance matching and Smith Chart are given.
Microwave passive circuits	2 ～ 3	Connector, circuit device in waveguide, impedance matching load, attenuator, phase shifter, T-blanch, isolator, circuilator, directional coupler, power divider/combiner are given.
Microwave resonator and filter	2 ～ 3	Microwave resonator and filter are given.
Microwave tubes	1 ～ 2	Generation/amplifier mechanism of microwave tubes of Klystron, TWT, magnetron are given.
Micorwave active circuits and semiconductor devices	2 ～ 3	Diode as microwave passive semiconducotor and FET and HBT as microwave active semiconductors are given. Its applications like Parametric amplifier are given.
Microwave Applications	3 ～ 4	Theory, requirements, and typical components of RF circuits in mobile communication are given. The other applications of radar, microwave heating, and wireless power transmission are given.

【Textbook】Masamitsu Nakajima: Microwave Engineering (in Japanese) (Morikita Syuppan)

【Textbook(supplemental)】Toshio Nojima and Yasushi Yamao: RF Circuit Technologies for Mobile COmmunication (in Japanese)(IEICE)
Yoshihiro Konishi: Theory and Applications of Microwave Circuits (in Japanese) (Sogo Denshi Syuppan)

【Prerequisite(s)】"Radio Engineering", Maxwell's equations, theory of radio waves, electric circuits, Distributed parameter circuits

【Web Sites】

【Additional Information】

60480

Optical Communications

光通信工学

【Code】60480 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60550

Vacuum Electronic Engineering 2

真空電子工学 2

【Code】60550 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】Gikan Takaoka, Yasuhito Gotoh

【Course Description】Operational principles of electron and ion beam devices are given. First, microwave tubes which utilize the interaction between electron beam and electromagnetic wave are described. Next, Devices, processing systems, and aparatus for analysis which utilize interaction between electron beam and solids are described. Finally, those which utilize interaction between ion beam and solids are given.

【Grading】Grading will be done with the result of the term-end examination.

【Course Goals】The course goal is to understand the principle of electron/ion beam devices.

【Course Topics】

Theme	Class number of times	Description
General concepts of charged particle systems	1	Explanation on the nature of the charged particle beams is made, and then current status of the application of charged particle beams is presented.
Microwave tubes	5	After briefly giving the explanation of micro-vacuum tubes, operational principles of microwave tubes that utilize density modulation of electron beam; klystron, traveling wave tube, magnetron, gyrotron.
Operational principles of electron beam devices	4	After giving operational principles of electron beam devices, mechanisms of deposition, welding, curing, exposure, analysis with electron beams are presented.
Operational principles of ion beam devices	5	Operational principles of ion implantor, ion beam etching system, ion beam deposition system, and system for ion beam analysis are given. Finally, achievements will be evaluated.

【Textbook】Zyunzo Ishikawa, Science and Technology of Charged Particle Beams, CORONA PUBLISHING CO. LTD. (2001)

【Textbook(supplemental)】

【Prerequisite(s)】Vacuum Electronic Engineering 1

【Web Sites】

【Additional Information】

60560

Optoelectronic Devices

光電子デバイス工学

【Code】60560 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】Asano, Noda

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	4 〜 5	
	4 〜 5	
	4~5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60570

Fundamentals of Optical Engineering 2

光工学２

【Code】60570 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2 【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60670

Intelligent Systems

知能型システム論

【Code】60670 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	4	
	4	
	2	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61040

Electrical　Conduction in Condensed Matter

電気伝導

【Code】61040 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2 【Restriction】No Restriction
【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】A fundamental aspect of the electrical conduction in solids is discoursed in terms of physics based on the classical dynamics and later on the quantum physics. An important concept of the phonon and the electron-phonon is discoursed, which play a very important role in the electrical conduction in solids. The electrical conductivity is discoursed with a frequency from 0, that is dc, to optical frequency, by which a unified understanding of electrical conduction and the optical property is intended.

【Grading】Basically, an examination is imposed after the last class. A report may be imposed in case of necessity.

【Course Goals】This class in intended to bestow the understanding of the solid state physics of a level dealt in the celebrated textbook by Ashcroft and Mermin. It is also intended for those attending in this class to acquire an ability sufficient to strive through such a textbook by himself or herself after the class is completed.

【Course Topics】

Theme	Class number of times	Description
Drude model and Boltzmann equation	4	dc Conductivity and electrical conduction in a magnetic field are dealt with using the relaxation time based on the Drude model. The magnetoresistance and the Hall effect are discoursed. Corbino device and the van der Pauw method are discoursed and their electrical conduction is given analytically as a concrete example. The celebrated Boltzmann equation is derived at the beginning of this term and based on this equation the fundamental equation for the electrical conductivity is discoused.
Fundametals of quantum mechanics and the wavevector space	2	Very fundamental concepts of the quantum mechanics are discoursed using bra- and ket-vectors. After Fermi's golden rule is derived, the wavevector space is discoused, which plays an important role in the motion of electrons in solids.
Free electron model and the elecronic conduction in metals	3	The Fermi-Dirac statistics is discoursed, which is obeyed by electrons. The distribution for electrons when they are degenerated. The free electron model is discoursed as an ideal Fermi gas, extending to the electronic specific heat, thermal emission of electrons, and others. Various concepts of the Fermi surface, electron in a magnetic field, the reciplocal lattice, the effective mass and so on. A very important theorem of Bloch is derived and used to obtain the Boltzmann-Bloch equation, which is very important in calculating the electrical conduction in solids.
Electron-phonon interaction and the electrical conduction in metals and semiconductors	3	The concept of phonons is discoursed as are represented by energy quanta appearing by the result of quantization of the lattice vibration. The density states of phonon is derived, which is used to obtain the specific heat of lattice vibraion in passing. The scattering by phonons and that by electrons are discoursed with a stress on the main role in the conduction of electrons in solids. Based on this scattering mechanism, the resistivity and its temperature dependence are discoursed, which finally leads to the description of the famous Bloch-Gruneisen formula. The electrical conduction in semiconductors is also discoused with a special attention on the scattering.
Electrical conduction in superconductors	2	A remarkable phenomenon of superconductivity is discoursed first. Then, a phenomenological model of superconductivity by London brothers is discoursed, in which the London equation is derived and the Meissner effect, the perfect diamagnetism, is explained in terms of the London equation and the Maxwell equations. Very important concepts in superconductivity, such as the coherence length, penetration depth, lower and upper critical field, the order parameter, the energy gap, quasiparticles, and the semiconductor model are discoursed. Finally, the high frequency impedance or the surface impedance of superconductors is discoursed based mainly on the London model.
High frequency electical conductivity and optical conductivity	1	As an asymptotic form of the ac electrical conductivity when the frequency is increased to higher than several tens of THz, we have an optical conductivity, which is also described as an imaginary part of the dielectric constant. Thus we have a unified picture of the ac conductivity. By means of this term, the surface impedance, the skin effect, and the anomalous skin effect are discoursed. The famous Kramers-Kronig relation is derived from the causality rule to give a usuful relationship between the real part and the imaginary part of the optical conductivity or the dielectric constant.

【Textbook】Textbook is not used in the class in particular.

【Textbook(supplemental)】"Solid State Physics" by Ashcroft and Mermin

【Prerequisite(s)】Those who would like to attend in this class are recommended to study electrodynamics, statistical physics, and introduction to the solid state devices in advance. The lecture is, however, given in Japanese.

【Web Sites】Supplements to the lecture are given in the web site, of which the URL is http://www.kuee.kyoto-u.ac.jp/~suzuki/index.html.

【Additional Information】The content of the lecture is subject to change depending on the number of times of the lecture.

61080

Electric Power Engineering 2

電力工学２

【Code】61080 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2-3	
	2	
	1-2	
	1.5	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61100

Antenna and Propagation Engineering

アンテナ・伝搬工学

【Code】61100 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】

【Instructor】Mamoru Yamamoto, Hiroyuki Hashiguchi, Toru Sato

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2-3	
	3-4	
	2-3	
	2-3	
	1-2	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61130

Integraged Circuits Engineering

集積回路工学

【Code】61130 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	2	
	4	
	2	
	2	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

61150

Information and Communication Engineering

情報通信工学

【Code】61150 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	3	
	3	
	3	
	3	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

62000

Electrical and Electronic Engineering in Biomedical Applications

生体医療工学

【Code】62000 【Course Year】4th year 【Term】1st term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】Lecture 【Language】

【Instructor】T. Matsuda, T. Kobayashi, K. Koyamada, S. Ishii, S. Doi, E. Furutani, S. Oba, H. Shimoda, M. Nakao

【Course Description】The course provides technologies based on electrical and electronic engineering in biomedical applications.

【Grading】A report is given in the class on each theme for evaluating the level of understanding of the fundamentals of electrical and electronic engineering in biomedical applications. Rating is based on the comprehensive evaluation of the reports.

【Course Goals】To acquire fundamental knowledge of physiological phenomena and functions, and mathematical models, and understand simulation and analysis methods in biomedical applications

【Course Topics】

Theme	Class number of times	Description
cell/biodynamics simulation	2-3	electrophysiology, computer simulation of cell and biodynamics
brain function measurement	2-3	brain nerve system, magnetoencephalogram (MEG), functional magnetic resonance imaging (fMRI), and their applications
visualization	2-3	visualization techniques for numerical simulation, steering, optimization
modeling and simulation of brain nerve system	2-3	simulation of information processing in neuron, mathematical modeling and analysis of higher brain function, bioinformatics
cognitive engineering	2-3	features of human cognitive activities from the viewpoint of psychology, congnitive engineering and its applications
biomedical and clinical systems	2-3	design and analysis of physiological state control system, system engineering approach and biomedical application to life

【Textbook】Handouts are given at the class.

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】The contents of the lecture and their order are subject to changes depending on the situation each year.

60580

Laws and Regulations of Electric Power Engineering

電気法規

【Code】60580 【Course Year】4th year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	2	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

60590

Laws and Regulations of Radio Wave Engineering

電波法規

【Code】60590 【Course Year】4th year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	7	
	3	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

64000

English for Electrical and Electronic Engineering

電気電子英語

【Code】64000 【Course Year】4th year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	2	
	2	
	3	
	2	
	3	
	2-3	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

21050

Engineering Ethics

工学倫理

【Code】21050 【Course Year】4th year 【Term】2nd term 【Class day & Period】 【Location】 【Credits】2

【Restriction】No Restriction 【Lecture Form(s)】Lecture 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	
	1	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

21080

Introduction to Engineering

工学序論

【Code】21080 【Course Year】1st year 【Term】 【Class day & Period】 【Location】 【Credits】1

【Restriction】No Restriction 【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

22020

Exercise in English of Science and Technology

科学技術英語演習

【Code】22020 【Course Year】2nd year 【Term】【Class day & Period】【Location】【Credits】1 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

22110

Engineering and Ecology

工学とエコロジー (英語)

【Code】22110 【Course Year】【Term】1st term 【Class day & Period】【Location】【Credits】2 【Restriction】

【Lecture Form(s)】 【Language】English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1	
	2	
	3	
	4~5	
	6~7	
	8~11	
	12~13	
	14~15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

22210

Engineering and Economy

工学と経済（英語）

【Code】22210 【Course Year】【Term】2nd term 【Class day & Period】【Location】【Credits】2 【Restriction】

【Lecture Form(s)】 【Language】English 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description
	1~2	
	3~4	
	5~6	
	7~8	
	9~10	
	11~13	
	14~15	

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

24010

Global Leadership Seminar I

ＧＬセミナーＩ

【Code】24010 【Course Year】3rd year 【Term】【Class day & Period】【Location】【Credits】1 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

【Course Goals】

【Course Topics】

Theme	Class number of times	Description

【Textbook】

【Textbook(supplemental)】

【Prerequisite(s)】

【Web Sites】

【Additional Information】

25010

Global Leadership Seminar II

ＧＬセミナーⅡ

【Code】25010 【Course Year】4th year 【Term】【Class day & Period】【Location】【Credits】1 【Restriction】

【Lecture Form(s)】 【Language】 【Instructor】

【Course Description】

【Grading】

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【Web Sites】

【Additional Information】

工学部シラバス 2012 年度版
（[D] Electrical and Electronic Engineering）
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2012 年 4 月 1 日発行（非売品）

編集者　京都大学工学部教務課
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デザイン　工学研究科附属情報センター

工学部シラバス 2012 年度版

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- [B] Architecture
- [C] Engineering Science
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- [E] Informatics and Mathematical Science
- [F] Industrial Chemistry
- **オンライン版**　http://www.t.kyoto-u.ac.jp/syllabus-s/

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京都大学工学部 2012.4