Course number	U-ENG20 42105 LJ77		
Course title (and course title in English)	工学倫理 Engineering Ethics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Professor,SOTOWA KENICHIRO Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Modern ethics based on engineering aspect are becoming essential to present engineers and scientists. Instructors from various faculties give lectures about ethics in their research fields.

[Course objectives]

The goal of this class is to understand engineering ethics, and to develop the ability to judge by yourself when you encounter ethical issues.

[Course schedule and contents]

(4/8) The central topic is what is ethics for engineers and what is significance of studying ethics for engineers.
(4/15) “General research ethics"
Lectures on the concept of writing academic papers with ethics.
(4/22) ”Ethical Theories for Engineering Ethics ”
This lecture focus on various ideas in ethics (utilitarianism, deontology, virtue ethics, professional ethics etc.) which will be useful for thinking about particular ethical problems in engineering ethics. This Lecture will be conducted online by using zoom.
(5/6) “Engineering Ethics as a Professional Ethics: ”
This lecture discusses basic ideas of engineering ethics in comparison with other fields of applied ethics. In particular, it discusses the characteristics of engineering ethics as professional ethics and what engineers as professionals are required to do.
(5/13) “Ethics for Engineers ”
Engineers have to go through some ethical issues about research, development, design, manufacturing, and maintenance. In particular, the ethical decisions of engineers need to be considered for society and environment.
(5/20) Press Release is an essential process for introducing the research to our society through various medias. In this lecture, issues related to Press Release will be addressed and discussed with several examples including SNS release. Lecture will be conducted by Zoom.
(5/27) "Ethics in Water Supply."
It is a basic right in a society that a person can receive and use safe water in sufficient quantity. In addition, a person of water supply utility is recognized to be an essential worker. Taking drinking water supply as a topic, ethics required for a water supplier and an engineer is discussed. It is given by Zoom.
(6/3) “Forensic Analysis ”
Forensic repots are sometimes requested by the court in order to clarify the charge of incidents. The nylon rope incident, the Wakayama curry poisoning incident, and the pig iron incident are explained as examples. How to write the forensic report is explained in order to avoid the ethical problems. (Zoom&Youtube)
(6/10) “Patents and Ethics (Part 1) ”
This course will teach the students about 1) patent systems which protect inventions and research results and

Continue to 工学倫理(2)↓↓↓

工学倫理(2)

2) ethical issues in patents. The first class, in preparation for the next subject of patent ethics, introduces Japan's patent system with comparisons to the patent systems in the world's major countries and international framework.
(6/17) “ Patents and Ethics (Part 2) ”
Students, equipped with the basic knowledge of patent systems by the previous lecture, will get familier with actual case studies on ethical and legal issues in patents.
(6/24) "Urban Planning and Ethics"
The lecture focuses on the norms regulating the actions of the engineers involved in planning and designing urban areas, as well as on the normative consciousness required to facilitate such planning and design, demonstrating some examples on urban transport planning. This will be given via Zoom.
(7/1) “ General research ethics of synthetic chemistry ”
Lectures on the concept of writing academic papers and patents of synthetic chemisty with ethics.
(7/8) Architecture has developed by imitating beautiful buildings, but in recent years there has been an increase in the number of cases where copyright disputes have arisen. In addition, the appearance of architecture often causes landscape controversy because of its influence on the surrounding environment. Issues concerning the ethics and sociality of architecture are discussed while introducing overseas lawsuits and design processes.
(7/15) The materials engineer may stand on the side using materials as well as a side supplying materials. Some examples are introduced and, by this lecture, are argued about an ethic found from each situation by materials engineer. Note that this lecture is going to be carried out in ZOOM, but may be changed to the on-demand on account of the speaker.
(7/29) "Engineer ethics in mechanical design"
Engineer ethics is not a passive and passive thinking that issues the action of simply following existing norms, but a more active and creative thinking to decide and design one's own actions. It requires the logical thinking and ethical thinking necessary for engineers. This is explained with past cases in mechanical design.

[Course requirements]

None

[Evaluation methods and policy]

Class participation and reports.

[Textbooks]

Lecture materials will be distributed.

[References, etc.]

（Reference books）

『Omnibus Engineering Ethics 』（Kyoritsu Shuppan Co., Ltd.）ISBN:978-4320071964
『Practical Engineering Ethics - A Short Course, New Edition』（Kagaku-Dojin Publishing Company,INC）ISBN:9784759811551
『Engineering Ethics (Revised Edition)』（CORONA PUBLISHING CO.,LTD.）ISBN:978-4-339-07798-8
『World of Engineering Ethics (3rd Edition)』（Morikita Publishing Co., Ltd.）ISBN:978-4-627-97303-9

Continue to 工学倫理(3)↓↓↓

工学倫理(3)

[Study outside of class (preparation and review)]

The assignment of the report will be given for each lesson.

（Other information (office hours, etc.)）

The class order is subject to change.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG20 12108 LJ77		
Course title (and course title in English)	工学序論 Introduction to Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,TAKATSU HIROSHI Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI Graduate School of Engineering Professor,MATSUNO FUMITOSHI Research Institute for Sustainable Humanosphere Professor,YAMAMOTO MAMORU Graduate School of Engineering Professor,NUMATA KEIJI Graduate School of Informatics Professor,MINATO SHINICHI Graduate School of Engineering Professor,UNO NOBUHIRO Graduate School of Engineering Professor,KANETA TAKASHI

Target year	1st year students or above	Number of credits	1	Year/semesters	2022/Intensive, First semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Engineering is to inquire after truth, to develop useful technologies, and to establish ways how to give back development results of technology to the society.
First, we offer special lectures regarding the basic knowledge that students in faculty of engineering are expected to have.
Then, we offer a series of intensive lectures about how engineering can suggest solutions of current and future problems of our society, the value of technology, and the responsibilities that researchers and engineers are expected to fulfill.

[Course objectives]

Students learn basic matters such as attitudes and responsibilities they are expected to take as a member of social community. They find value in studying engineering and become to consider what they do in future by understanding technology can suggest solutions of problems our society is facing, especially problems about safety and security.

[Course schedule and contents]

Special lectures,1time, About basic knowledge and attitude as students who start to learn engineering, and the role of engineering in society.
Intensive lectures,6times, A series of lectures offered by special lecturers playing on global stages of science and technology. Lectures are for understanding the role that technology is playing in modern society, for reconfirming importance to study engineering and to work as a researcher and engineer in society, and are to be opportunities to consider own future path. Essays are assigned in every lecture to summarize the lecture content and opinions of other students.
Schedule of the lectures are announced later.

Continue to 工学序論(2)↓↓↓

工学序論(2)

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on participation and essays assigned in every intensive lecture.

[Textbooks]

Specify if necessary.

[References, etc.]

（Reference books）

Specify if necessary.

[Study outside of class (preparation and review)]

Specify if necessary.

（Other information (office hours, etc.)）

Information about lecturers and contents of lectures are announced on electric bulletin boards.
Please confirm to your department office that the credit of this course is admitted to graduation requirements.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG20 32402 SE77		
Course title (and course title in English)	工学部国際インターンシップ１ Faculty of Engineering International Internship 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HONDA MITSURU

Target year	3rd year students or above	Number of credits	1	Year/semesters	2022/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese and English

[Overview and purpose of the course]

Acquisition of international skills with the training of foreign language through the internship programs hosted by the University, the Faculty of Engineering, or the undergraduate school the applicant belongs to.

[Course objectives]

The acquisition of international skills with the training of foreign language through the to internship programs hosted by the University is the major expectation to the students.

[Course schedule and contents]

Overseas Internship,1time,The contents to be acquired should be described in the brochure of each internship program.
Final Presentation,1time,A presentation by the student is required followed by discussion among participants.

[Course requirements]

Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

[Evaluation methods and policy]

Marit rating is done based on the presentation or reports after each internship program. Each Department responsible to identify if the credit earned by this subject to be included as mandatory ones or not. If the credit is not included in the undergraduate school in which the participant belongs to, the credit is granted by the Global Leadership Education Center as a optional credit. The number of credits, either 1 or 2, will be determined depending on the contents and the duration of the program that the participant has participated in.

[Textbooks]

Continue to 工学部国際インターンシップ１(2)↓↓↓

工学部国際インターンシップ１(2)

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the undergraduate school or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course that includes off-campus training classes.

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG20 22403 SJ77		
Course title (and course title in English)	グローバル・リーダーシップセミナーI(企業調査研究) Global Leadership Seminar I (Study for methodology in a company)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,hirai yoshikazu Graduate School of Engineering Senior Lecturer,KOMIYAMA YOSUKE Graduate School of Engineering Professor,HONDA MITSURU

Target year	2nd year students or above	Number of credits	1	Year/semesters	2022/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

The purpose of this course is to study about how worldwide leading company, institute, etc. make proposals and find solutions for expanding their own technologies to the international market. Throughout hands-on training on their laboratory, students investigate the methodology of team organization, proposal, market prediction and conception ability by group works. After the investigation, students are expected to improve their comprehension and explanation capability. As extended exersice subject of this course, the Global Leadership Seminar II is opened in the second semester.

[Course objectives]

The goal of this course is to improve student's comprehension and explanation capability for processes of proposal and expansion on the international market invesitigating worldwide leading companies by group work.

[Course schedule and contents]

Week 1, Guidance
Week 2-13, Hands-on training
Week 14, Pre-presentation
Week 15, Final presentation

[Course requirements]

How to register will be announced later. Students who want to join this course is requested to attend the first class.

[Evaluation methods and policy]

Students are prohibited to skip hands-on training. Evaluation will be based on presentation.

[Textbooks]

Not used

Continue to グローバル・リーダーシップセミナーI(企業調査研究) (2)↓↓↓

グローバル・リーダーシップセミナーI(企業調査研究)(2)

[References, etc.]

（Reference books）

（Related URLs）

http://www.glc.t.kyoto-u.ac.jp/ugrad

[Study outside of class (preparation and review)]

Investigating companies in advance. Analyzing the result from hands-on training. Preparing presentation.

（Other information (office hours, etc.)）

How to register will be announced later. Students who want to join this course is requested to attend the first class. Students are prohibited to skip hands-on training. Evaluation will be based on presentation.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
An omnibus course delivered by invited lecturers and guest speakers from different companies, etc.

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG20 32502 SE77		
Course title (and course title in English)	工学部国際インターンシップ２ Faculty of Engineering International Internship 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HONDA MITSURU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese and English

[Overview and purpose of the course]

Acqusition of international skills with wth the training of foreign language through the participation to the international internship programs held by the Faculty of Engineering or its subsidiary bodies.

[Course objectives]

The acquisition of international and foreign language skills through the participation to international programs is expected. Detailed objectives of the participation should be identified by each program.

[Course schedule and contents]

Overseas Internship,1time,The contents to be acquired should be described in the brochure of each internship program.
Final Presentation,1time,A presentation by the student is required followed by discussion among participants.

[Course requirements]

Described in the application booklet for each internship program. The registrant is requested to have enough language skills for the participation.

[Evaluation methods and policy]

Marit rating is done based on the presentation or reports after each internship program. Each Department responsible to identify if the credit earned by this subject to be included as mandatory ones or not. If the credit is not included in the undergraduate school in which the participant belongs to, the credit is granted by the Global Leadership Education Center as a optional credit. The number of credits, either 1 or 2, will be determined depending on the contents and the duration of the program that the participant has participated in.

[Textbooks]

Continue to 工学部国際インターンシップ２(2)↓↓↓

工学部国際インターンシップ２(2)

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

It is required for students to check if the internship program to participate in could be evaluated as part of mandatory credits or not and could earn how many credits before the participation to the undergraduate school or educational program the student in enrolled. If the credit could not be treated as mandatory ones, get in touch with the Global Leadership Engineering Education Center.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course that includes off-campus training classes.

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

Course number	U-ENG20 22503 SJ77		
Course title (and course title in English)	グローバル・リーダーシップセミナーII(イノベーションとその事業化) Global Leadership Seminar II (Innovation and its commercialization)	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HONDA MITSURU Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,TAKATSU HIROSHI

Target year	2nd year students or above	Number of credits	1	Year/semesters	2022/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

This course is a small-group workshop program where students are supposed to extract or set up challenges by themselves aiming at creating new social values. In concrete, abilities of planning and problem-solving are trained through group works in residential training and skills of presentation and communication are enhanced through oral presentations regarding contents of the proposal at each step of the process from a preliminary draft to its completion.

[Course objectives]

Ability of planning, from extraction or setting up challenges to proposal of solutions aiming at creating new social values, is trained through group works.

[Course schedule and contents]

※Depending on the situation of COVID-19 pandemic, all lectures will be given online and residential training will be canceled.

Orientation,1time,A brief overview and a schedule of the course are explained and working groups are organized.
Lectures,2times,Lectures by experts are given.
Group works,3times,Setting up challenges, extraction of problems, collecting information, and group works are done.
Residential training,7times,Through intensive group works based on discussion, a proposal for solving problems is planned, a draft report is made, and a few presentations are made.
Preliminary review meeting,1time,A preliminary review meeting is held and discussions are made.
Report meeting,1time,Final presentations are made and reports are submitted.

[Course requirements]

None

[Evaluation methods and policy]

※Depending on the situation of COVID-19 pandemic, all lectures will be given online and residential training will be canceled.

It is required to join the residential training. A report meeting is held and comprehensive evaluation concerning abilities in group discussion to extract or set up challenges and to propose solutions for achieving

Continue to グローバル・リーダーシップセミナーII(イノベーションとその事業化)(2)↓↓↓

a goal is made through presentation of the proposal as well as a submitted report.

[Textbooks]

Will be indicated as necessary.

[References, etc.]

（Reference books）

Will be indicated as necessary.

[Study outside of class (preparation and review)]

Will be indicated as necessary.

（Other information (office hours, etc.)）

Course open period: October to January

*It depends on divisions which students belong to whether the earned credits are admitted as credits required for graduation. Please refer to the syllabus of your division.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 16003 LJ72		
Course title (and course title in English)	電気電子回路 Electric and Electronic Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,WADA OSAMI

Target year	1st year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The first half of the course discusses the basics of three phase circuits, methods of analyzing passive circuits that include transformers, and the construction of systematic circuit formulas. The second half explains methods of analyzing circuits that include active components, such as transistors, using electric circuit theory, then describes the handling of frequency characteristics of circuits and basic switching operations of transistor circuits.

[Course objectives]

- Review basic knowledge on handling of electric circuits, and develop the ability to analyze basic electric circuits.
- Understand the basics of three phase circuits.
- Understand circuits that include independent voltage and current sources and controlled sources, as well as equivalent circuits of transformers.
- Understand handling of frequency characteristics of circuits.
- Understand methods to analyze nonlinear circuits including active components as linear circuits.
- Understand the basic operation of semiconductor devices.

[Course schedule and contents]

(1-2) Basics of three phase circuits, [2 classes]:
Following up on Basic Theory of Electric Circuits (60630), review the representation of sine waves in complex form, and explain the basics of single phase three wire circuits and symmetrical three phase circuits.
(3-6) Passive circuit analysis methods, [4 classes]:
Explain handling of circuits using Thevenin's theorem and Norton's theorem, equivalent sources and equivalent circuits.
Explain mutual inductance and transformers; equivalent circuits, the coupling factor, ideal transformer, impedance conversion, analysis of circuits including transformers.
(7-8) Circuit equations, [2 classes]:
Explain construction of the loop equations and the nodal equations that can realize systematic circuit analysis even when very large number of elements are included.
(9) Basics of semiconductor, [1 class]:
Explain p-n junctions of semiconductors that make up diodes, transistors, etc., as well as their basic characteristics.
(10-11) Active circuit analysis, [2 classes]:
Explain DC biasing for linear operation of electron tubes, transistors, etc. as well as AC small signal equivalent circuits for handling amplification of signals, etc., and explain the concept of controlled voltage sources and controlled current sources, and methods of analyzing electronic circuits using linear circuit theory.

Continue to 電気電子回路(2)↓↓↓

電気電子回路(2)

(12-13) Frequency characteristics of electronic circuits, [2 classes]:
Explain dB (decibel) notation for representing the radio of electric power, voltage, current, etc., and describe the frequency characteristics of simple amplifier circuits.
(14) Basics of semiconductors and binary operation of active circuits, [1 class]:
Describe transistor's switching operation.
(15) Confirmation of learning attainment, [1 class]:
Confirm the degree of learning attained in the course.

[Course requirements]

Students should have learned the content of Basic Theory of Electric Circuits (60630), or an equivalent basic course in electric circuits.
It is not required to have obtained credits from the above courses.

[Evaluation methods and policy]

Evaluation will be based on final examination grade.
Report topics will be assigned in class, and reports on these themes will be factored into the final grade.

[Textbooks]

奥村浩士：電気回路理論（朝倉書店) isbn{}{9784254220490}，Also, printouts are distributed (“Course materials” on KULASIS)

[References, etc.]

（Reference books）
その他, **柳沢**: **回路理論基礎** (**電気学会大学講座**)（**電気学会**）ISBN： 9784886862044 ibid{}{ TW86015136}
北野: **電子回路の基礎** (**培風館**) isbn{}{456303553X}
北野: **電子回路の基礎**(http://www.kuee.kyoto-u.ac.jp/~kitano/ec/) (**レイメイ社**) ibid{}{BB04087527}

[Study outside of class (preparation and review)]

“Course materials” are uploaded to KULASIS, so please download and refer to them as appropriate.

（Other information (office hours, etc.)）

After class (Monday, second period), I will be available to answer questions at the Yoshida Campus.
Questions are also welcomed by email.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 26008 LJ72　U-ENG26 26008 LJ57		
Course title (and course title in English)	電磁気学 1 Electromagnetic Theory 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUO TETSUJI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Students will learn electrostatic filed, electrostatic energy, electrostatic force in vacuum and dielectric media, and magnetostatic field in vacuum.

[Course objectives]

To understand basics of the electrostatics in vacuum and dielectric media, and the magnetostatics in vacuum.

[Course schedule and contents]

1. Electrostatic fields in vacuum (2-3 times)

2. Electrostatic fileds in dielectric media (2-3 times)

3. Electrostatic energy, Electrostatic filed and boundary value problems in electrostatic fields (5-6 times)

4. Steady-state currents and magnetostatic fields in vacuum (3-4times)

5. Academic achievement test (1 time)

[Course requirements]

Vector Analysis

[Evaluation methods and policy]

By a term examination (raw score)

[Textbooks]

島崎・松尾 『電磁気学』

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

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（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36009 LJ57　U-ENG26 36009 LJ72		
Course title (and course title in English)	電磁気学２ Electromagnetic Theory 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUO TETSUJI Graduate School of Engineering Professor,AMEMIYA NAOYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Students will learn ferromagnetic media, electromagnetic force, electromagnetic induction, Maxwell's equations and electromagnetic wave.

[Course objectives]

To understand basics of the electromagnetics: ferromagnetic media, electromagnetic force, electromagnetic induction, Maxwell's equations and electromagnetic wave.

[Course schedule and contents]

Ferromagnetic media (3 times)

Electromagnetic force (2-3 times)

Electromagnetic induction (3-4 times)

Maxwell's equations and electromagnetic wave (3-4 times)

Computational electromagnetics (1-2 times)

Academic achievement test (1 time)

[Course requirements]

Electromagnetic Theory 1

[Evaluation methods and policy]

By a term examination (raw score)

[Textbooks]

島崎・松尾 『電磁気学』

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

-

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 26010 LJ72		
Course title (and course title in English)	電子回路 Electronic Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,SUGIYAMA KAZUHIKO

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Modeling of active devices (3 times):
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 times)
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 times)
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 times):
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.

Oscillators (2 times):
The principle of the oscillator circuit is lectured as a concept of the positive feedback. Various oscillator

Continue to 電子回路(2)↓↓↓

circuits are introduced with their characteristics.

Others (1 time):
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.

Feedback (1 time):
We make an examination in order to investigate the achievement in the lecture. We will offer an additional chance for discussion to the students who do not achieve satisfactorily.

[Course requirements]

"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 to achieve this course.)

[Evaluation methods and policy]

Examination and reports. Details about evaluation of the reports are opened on the homepage of this lecture located on PandA.

[Textbooks]

Masao Kitano 『Fundamentals of Electronic Circuits』 （Reimei Publishing, Kyoto） （ibid:BB04087527）

[References, etc.]

（Reference books）

In addition to Japanese books, Tietze and Schenk: Electronic Circuits (Splinger) isbn{}{354050608X} isbn{}{9783540004295};
Hayes and Horowitz: Student Manual for the Art of Electronics (Cambridge) isbn{}{0521377099}

（Related URLs）

(Link to the homepage of this course is here; (https://panda.ecs.kyoto-u.ac.jp/portal/site/2022-110-6010-000) or (https://panda.ecs.kyoto-u.ac.jp/portal/). Sorry for Japanese version only.)

[Study outside of class (preparation and review)]

In case you need.

（Other information (office hours, etc.)）

The topics will be selected owing to limit of lecture time.

The students should prepare quotBar Coverquot from the website of the Faculty of Electric and Electronic Engineering (http://www.s-ee.t.kyoto-u.ac.jp/ja/student/index.html)) by themselves, and use it as a title page of each report and the exercise in the lecture.

Continue to 電子回路(3)↓↓↓

電子回路(3)

The homepage of this course is located on PandA (https://panda.ecs.kyoto-u.ac.jp/portal/).

Contact the instructor after the lecture, when the students have any questions.

The office hour is shown in KULASIS.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26012 LJ72　U-ENG26 26012 LJ11		
Course title (and course title in English)	論理回路 Logic Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,HASHIMOTO MASANORI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Fri.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

From this lecture, you can obtain basic knowledge that enables the analysis and design of small-scale logic circuits both for combinational and sequential operations.

[Course schedule and contents]

Following topics will be covered.　By assessing the understanding of the students and adding explanations and tasks when necessary, we will spend the number of weeks listed in [ ].

(1) Basics of logic functions [2 weeks]
Digital circuits and logic circus, number systems, Boolean algebra, logic functions, and logical expressions are covered.

(2) Logic minimization [4 weeks]
Methods for logic minimization using Boolean cubes and Karnaugh maps, Quine-McCluskey method, properties of logic functions are explained.

(3) Combinational circuit [2 weeks]
Logic gates, analysis and design of combinatorial circuits, representative combinational circuits are discussed.

(4) Sequential circuit [5 weeks]
Operation and expression of sequential circuits, organization and operation of flip-flops, analysis and design of sequential circuits, synchronous counters and registers are explained.

(5) Arithmetic circuit [1 week]
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.

(6) Confirment of understanding and feedback [1 week]
The level of understanding on this lecture will be confirmed.　Feedback will be given if necessary.

Continue to 論理回路(2)↓↓↓

論理回路(2)

[Course requirements]

None

[Evaluation methods and policy]

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

[Textbooks]

Naofumi Takagi 『Logic Circuits』 （Ohmsha）ISBN:9784274215995

[References, etc.]

（Reference books）

Teruhiko Yamada 『Theory of Logic Circuits』 （Morikita Publishing）ISBN:4627805306
Keikichi Tamaru 『Basics of Logic Circuits』 （Kougaku-Tosho）ISBN:4769202040

[Study outside of class (preparation and review)]

Related part in the textbook should be read before lecture.　Practices in the textbook should be solved when the topic is covered by the lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 26013 LJ72		
Course title (and course title in English)	情報理論 Information Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,YAMAMOTO KOUJI Graduate School of Informatics Associate Professor,MURATA HIDEKAZU

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course discusses information storage (compression), and basic issues related to information transmission, especially information source coding and communication channel coding. Lectures also describe concrete error detection codes (cyclic codes, etc.) and error correction codes. The ABCs of information security are also touched upon.

[Course objectives]

Students will grasp basic concepts concerning information storage (compression) and transmission. They will also understand concrete error detection codes and error correction codes.

[Course schedule and contents]

Information theory (1 class) Introduction to the history, aims, and current applications, etc., of information theory.
Information source coding (4 classes) Explanation is provided of various types of communication channel models, including memoryless sources and Markov information sources, followed by discussion of information source coding theorems. Hu.man and Lempel-Ziv coding and other concrete information source coding methods are described.
Channel coding theorems (2 classes) Mutual information and channel capacity are discussed, together with Shannon.s channel coding theorem.
Error detection codes and error correction codes (5 classes) Detailed explanation is made of the principles of parity check code, Hamming code, and cyclic code. Also, based on knowledge of finite fields (Galois .eld), BCH code, etc., are introduced as multiple error correction codes.
Information security (2 classes) Opportunities have increased for the electronic transmission, via networks, of important information. Explanation is provided of the coding that is essential to secure the safety of that information; special focus is given to basic items concerning public-key encryption systems, digital signatures and authentication, and other key issues.
Confirmation of extent of student learning (1 class) Confirmation is made of the extent that students have learned the contents of this course.

[Course requirements]

Knowledge of probability (probability theory fundamentals) and algebra is desirable.

Continue to 情報理論(2)↓↓↓

情報理論(2)

[Evaluation methods and policy]

Based on a written examination (max. score =100), although consideration is also given to evaluations of small tests or reports (total of 1 or 2 times, max. score = 10 for each). The max. of the total score is 100.

[Textbooks]

『情報理論（改訂2版）』ISBN:9784274223259

[References, etc.]

（Reference books）

『代数系入門』ISBN:9784000298735
『誤り訂正符号入門』ISBN:9784627817111
『代数系と符号理論入門』ISBN:9784339024463

[Study outside of class (preparation and review)]

Students are requested to possess, and to review, their knowledge of probability (probability theory fundamentals) and algebra.

（Other information (office hours, etc.)）

A portion of classes and topics may be either omitted or newly added.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26015 LJ72　U-ENG26 26015 LJ52		
Course title (and course title in English)	物性・デバイス基礎論 Fundamentals of Electron Physics and Devices	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KIMOTO TSUNENOBU Graduate School of Engineering Associate Professor,ETO YUJIRO

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Quantum mechnics,4-5times,
Statistics,3-4times,
Solid state physics,2-3times,
Electrons in solids,3-4times,
Summary,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Tanaka Tetsuro: Busseikougaku no kiso (Asakura Shoten) isbn{}{4254210035}

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26016 LJ72		
Course title (and course title in English)	計算機工学 Computer Hardware Design	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,SATOU TAKASHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course attempts to provide a foundation for students to understand modern computer architecture and to apply the insights and principles to understand operation of the computer systems.

[Course objectives]

The primary goal is to help students understand how computer systems work. The course places a strong emphasis on the organization and operation of a basic pipelined microprocessor.

[Course schedule and contents]

Computer systems overview (2 weeks): Fundamentals of computers --- history, data representation and arithmetic on computers, instruction sets, and components.
Number representation and binary arithmetics (4 weeks): Integers, fixed point float, IEEE 754 floating numbers; binary arithmetic, and logic operations in ALU.
Machine language (2 weeks): Instruction formats of RISC processors; basic assembly language
ALU and data path (2 weeks): Composition of ALU, highlighting the correspondence with ISA
Control path and pipelining (4 weeks): Data flow and control in the computer; pipelining; instruction execution
Course summary (1 week): Summarize overall computer architecture

[Course requirements]

Logic circuits (60120).

[Evaluation methods and policy]

A final course grade is given on the basis of the end-of-term exam. Results of homework assignments given in almost every class may be additionally considered for the grading.

[Textbooks]

Printed handouts are provided. Recommended to have following supplemental textbook.

Continue to 計算機工学(2)↓↓↓

計算機工学(2)

[References, etc.]

（Reference books）

David Patterson and John Hennessy 『Computer Organization and Design: The Hardware/Software Interface』

（Related URLs）

(Materials are provided through KULASIS.https://www.k.kyoto-u.ac.jp/student/)

[Study outside of class (preparation and review)]

Short quiz will be given as a homework at the end of the classes, which covers some of the key topics discussed in the lecture. Students are asked to solve them and submit by the next class. Through solving problems, students should try to deepen the understanding of the design concepts and the mechanisms of the computers.

（Other information (office hours, etc.)）

This syllabus is subject to change. Any changes to the syllabus shall be distributed in writing, which may include electronic communication.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 36022 LJ72		
Course title (and course title in English)	電気回路 Electric Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,HISAKADO TAKASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The course introduces the fundamentals of transmission line which is essensial for high-frequency circuit design. Topics covered include: circuit model of transmission line; telegraph equation, transient and steady states in transmission line, analysis with Laplace transform.

[Course objectives]

Students are expected to learn the transient and steady states of the circuit with transmission line.

[Course schedule and contents]

Distributed and lumped circuit,1time,We introduce transmission line.
Transient analysis,5times,We introduce the circuit model of transmission line and derive telegraph equation.
Transient analysis in transmission line is explained.
AC analysis,3times,Steady state analysis in transmissionline.
Transient analysis of lumped circuit,3times,Transient analysis with Laplace transform
synthesis of circuit,2times,Synthesis of circuit by network functions.
academic achievement test,1time,The level of understanding on this lecture will be confirmed.

[Course requirements]

None

[Evaluation methods and policy]

Reports and examination

[Textbooks]

Instructed during class

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

After lectures, solve the problems in the print.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36026 LJ72		
Course title (and course title in English)	自動制御工学 Control Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HAGIWARA TOMOMICHI Graduate School of Engineering Senior Lecturer,HOSOE YOUHEI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Feedback systems and the Laplace transformation (4--5 weeks)

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 weeks)

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 weeks)

Transient responses of systems and algebraic stability criteria of feedback systems.

Frequency responses (4--5 weeks)

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. Checking degrees of understanding of all the lecture topics, e.g., through comments on the exam, closes the class.

Continue to 自動制御工学(2)↓↓↓

自動制御工学(2)

[Course requirements]

Theory of functions in complex variables, as well as basic understanding about complex numbers.

[Evaluation methods and policy]

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

[Textbooks]

荒木光彦 『古典制御理論[基礎編]』（培風館）ISBN:4563069019

[References, etc.]

（Reference books）

（Related URLs）

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

[Study outside of class (preparation and review)]

Reviewing the topics in the preceding part of the lecture is always important before attending the class. Receive exercise problems by attending the class upon the beginning of the class, and submit the answer reports to receive marking and comments by TA.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36027 LJ72		
Course title (and course title in English)	ディジタル制御 Digital Control	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HAGIWARA TOMOMICHI Graduate School of Engineering Senior Lecturer,HOSOE YOUHEI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Fundamentals of digital control and the z-transformation (4--5 weeks)

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 weeks)

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 weeks)

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. Checking degrees of understanding of all the lecture topics, e.g., through comments on the exam, closes the class.

[Course requirements]

Control Engineering; Exercise of Computer Programming in Electrical and Electronic Engineering (basic understanding about programming)

Continue to ディジタル制御(2)↓↓↓

ディジタル制御(2)

[Evaluation methods and policy]

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

[Textbooks]

荒木光彦 『ディジタル制御理論入門』（朝倉書店）ISBN:4254209649

[References, etc.]

（Reference books）

（Related URLs）

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

[Study outside of class (preparation and review)]

Reviewing the topics in the preceding part of the lecture is always important before attending the class. Receive exercise problems by attending the class upon the beginning of the class, and submit the answer reports to receive marking and comments by TA.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36031 LJ72		
Course title (and course title in English)	放電工学 Electric Discharge and Breakdown	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,YOSUKE ITOH Part-time Lecturer,HIROTSU KENICHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture mainly explains the discharge and dielectric breakdown phenomena in gases and the underlying mechanisms. The specific focus shall be on the collision phenomena, excitation and ionization processes, basic processes in ionizing gas (such as transport phenomena), discharge inception theory and Paschen's law, various discharge types (such as corona, glow, and arc), discharge in solids, and creeping discharge.

[Course objectives]

To deepen the understanding of basic discharge processes and discharge maintenance mechanisms; as well as thoroughly deepening the understanding of basic characteristics and engineering application fields of various discharge forms. Such knowledge is vital for professionals involved in electrical and electronic engineering.

[Course schedule and contents]

1. Discharge in gas and its engineering role [1 week] (Hirotsu)
Gas discharge phenomena are outlined, and the purpose of the lecture is described.

2. Fundamental process in ionized gas [4 week] (Hirotsu)
Fundamental process in ionized gas such as collision between gas molecules, excitation, ionization, transportation, recombination is described.

3. Start of gas discharge [3 weeks] (Ito)
Explanation of electron avalanche phenomenon when an electric field is applied to a gas, and description of the mechanism of discharge inception in a gas and Paschen's law. Moreover, the streamer theory will be explained.

4. Steady gas discharge 1 (corona discharge, long gap discharge, lightning) [4 weeks] (Ito)
Explanation of discharge form after a discharge starts. Here, each theory regarding discharge phenomena such as corona discharge, long gap discharge, and lightning discharge is described.

5. Steady gas discharge 2 (glow discharge, arc discharge) [1 week] (Hirotsu)
Explanation of various discharge forms after a discharge starts. Here, each theory of discharge phenomena such as glow discharge and arc discharge is described. Furthermore, explanation of the technology used for various discharges

Continue to 放電工学(2)↓↓↓

放電工学(2)

6. Discharge in solids, creeping discharge [1 week] (Hirotsu)
Description of various discharge phenomena theories regarding discharges related to solids. Furthermore, explanation of countermeasures and uses of various types of discharge.

7. Verify learning attainment [1 week]
Learning attainment verified for the entire lecture.

[Course requirements]

A rudimentary knowledge of physics of gasses is sufficient.

[Evaluation methods and policy]

Evaluation is performed based on regular test scores. Attendance and quiz results may be considered.

[Textbooks]

Not used

[References, etc.]

（Reference books）

The Institute of Electrical Engineers of Japan 「**電離気体論**」 isbn{}{4886861067}
Ohmsha, Ltd. 「**高電圧工学**」 isbn{}{4274214448}

[Study outside of class (preparation and review)]

Instructions should be given, as needed, during lectures but reviewing lecture content using provided materials is desirable.

（Other information (office hours, etc.)）

Exercise, small test, report test, etc., will be conducted as necessary.
The contents and order may be partially changed according to the progress of the lecture in the fiscal year concerned.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36032 LJ72		
Course title (and course title in English)	通信基礎論 Modulation Theory in Electrical Communication	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,HARADA HIROSHI Graduate School of Informatics Associate Professor,MURATA HIDEKAZU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course discusses all types of modulation methods, that is, the theories of amplitude, frequency, phase, pulse modulations, as well as the principles of modulation/demodulation. Further focus is made on signal processing basics, sampling theory, etc., including of related applications.

[Course objectives]

Students will gain an understanding of the fundamentals of communication theory, used in mobile telephones, wireless local area networks (LAN), optical fiber communications, etc. Specifically, students will master signal expression and signal processing (modulation/demodulation) within time axis and frequency axis of communication signals, chiefly in the physical layers of communication signals.

[Course schedule and contents]

"Signal processing (4-5 classes)
Clarification is made of the concept of “frequency,” and students learn of tools for handling frequency, namely, Fourier series and Fourier transforms and their practical applications. Discussion is next made especially of the basics of random signals and theories regarding the standardization and quantization of random signals.

Analog modulation and demodulation methods (5-6 classes)
Discussion is made of the principles of amplitude modulation and angle modulation and their generation and modulation methods, with comparison of their respective characteristics, including occupied bandwidth and signal-to-noise ratio, etc.

Digital modulation and demodulation methods (4-5 classes)
After description of various methods of pulse modulation, there is discussion of principles and methods of digital modulation types, including modulation phase shift keying (PSK), etc., plus the basics of signal space. Confirmation is made of the extent of student understanding, with supplementary discussion to further improve levels of understanding.

Confirmation of extent of student learning (1 class)
Confirmation is made of the extent that students have learned the contents of this course. Additional explanation is provided for those students whose understanding remains incomplete or imperfect.

Continue to 通信基礎論(2)↓↓↓

通信基礎論(2)

[Course requirements]

Students are required to have taken the course Industrial Mathematics (Fourier Analysis) and Electronic Circuits.

[Evaluation methods and policy]

Evaluation is made of extent of student's understanding of course contents via written examination.

[Textbooks]

守倉他『通信方式』（オーム社）ISBN:9784274214738

[References, etc.]

（Reference books）

寺田他: **情報通信工学** (**オーム社**) isbn{}{4274129322}

[Study outside of class (preparation and review)]

Students are required to have taken the course Industrial Mathematics (Fourier Analysis) and Electronic Circuits.

（Other information (office hours, etc.)）

After classes, from 10:30-12:00

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36033 LJ72		
Course title (and course title in English)	情報伝送工学 Information Transmission	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,MURATA HIDEKAZU Graduate School of Informatics Associate Professor,YAMAMOTO KOUJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

We will introduce mobile cellular systems, wireless LANs, Ethernet, optical disks, etc. as specific applications of information transmission. We also discuss issues in the design of each system and their solutions.

[Course objectives]

Students will gain an understanding of fundamental concepts involving highly reliable information transmissions via communication channels with noise and interference.

[Course schedule and contents]

(1) Communication systems (3 weeks)
Lectures discuss general configurations for communication systems and wireless communication systems, as well as link budget and channel capacity.

(2) Optical disks and Ethernets (2 weeks)
Discussions are made of pulse-code modulation (PCM) and baseband transmission required for understanding optical disks and Ethernets.

(3) Multiple access for wireless systems (2 weeks)
Discussions are made of multiplexing, multiple access, channel allocation, and user scheduling, which are necessary for mobile cellular systems and wireless LANs.

(4) Cellular systems (1 week)
We describe the cellular system that realizes wide area public wireless service and introduce the concept of clusters and handovers.

(5) Fading, and countermeasure techniques (2 weeks)
We introduce a typical model of fading in urban areas and countermeasure techniques, including diversity, etc.

(6) High-speed and high-efficiency technologies (2 weeks)
We introduce orthogonal frequency division multiplexing (OFDM) as high-speed transmission technologies.

(7) Spectral efficient technologies (2 weeks)
We introduce multiple-input and multiple-output (MIMO) transmission as spectral efficient technologies.

(8) Confirmation of extent of student learning (1 week)

Continue to 情報伝送工学(2)↓↓↓

情報伝送工学(2)

Confirmation (i.e., evaluation) is made of the extent that students understand the concepts involved in highly reliable information transmissions.

[Course requirements]

Students are recommended to have taken "Modulation Theory in Electrical Communication".

[Evaluation methods and policy]

【Evaluation method】
Written examination (up to 100 points), reports or exercises (total of 1 or 2 times, maximum of 5 points each) are carried out, and the total points (up to 100 points) are evaluated.

【Evaluation criteria】
Evaluation is based on the achievement level of the target.

[Textbooks]

守倉正博 『OHM大学テキスト 通信方式』（オーム社）ISBN:9784274214738

[References, etc.]

（Reference books）
鈴木博 『ディジタル通信の基礎』（数理工学社）ISBN:9784901683845

[Study outside of class (preparation and review)]

Portions of this course involve explanations of applications of "Modulation Theory in Electrical Communication". Students must review these by discovering for themselves the relationships between those applications and "Modulation Theory in Electrical Communication".

（Other information (office hours, etc.)）

Portions of course contents may be omitted, or additions may be made when necessary.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36034 LJ72		
Course title (and course title in English)	通信ネットワーク Telecommunication Networks	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Oki Eiji Graduate School of Informatics Associate Professor,SATO TAKEHIRO Part-time Lecturer,IKEDA SHINPEI Part-time Lecturer,KOBAYASHI TAKEO Part-time Lecturer,

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Lectures describing fundamental concepts related to communications networks such as circuit and packet switching, transmission control, network control, and communication protocols, as well as examples of a variety of communication networks ranging from access systems such as the Internet, wireless LAN, and FTTH.

[Course objectives]

Cultivate an understanding of the basics of communication network technologies to apply to current trends.

[Course schedule and contents]

Foundations of the exchange method and traffic theory, 3 sessions
These sessions will focus on trends in switching technology and the basic theory of traffic analysis.

Wide area network technology and its applications, 3 sessions
These sessions will focus on discussion of the structure of communication networks as an infrastructural component and various technical elements (exchanges, relay, wireless technologies, etc.) constituting the network.

Internet communication, 3 sessions
These sessions will aim to develop proficiency in the basic knowledge required for packet data communication and typical communication protocols.

LAN and protocols, 2 sessions
These sessions will discuss various access protocols and a local area network (LAN) using them.

Case study and development exercises, 3 sessions
These sessions will introduce the current trends in information communication services and systems, with examples of the application of IP nets, wireless LANs, and mobile IT systems, as well as analyze a number of case studies.

Confirment of learning achievement, 1 session
Confirm (evaluate) achievement of the learning objectives of the course.

Continue to 通信ネットワーク(2)↓↓↓

通信ネットワーク(2)

[Course requirements]

Having previously studied basic communication theory is desirable.

[Evaluation methods and policy]

Students will be comprehensively evaluated regarding their basic understanding of communication network technology based on regular examinations, reports, and exercises.

Specifically, regular examinations will be evaluated on a 100-point scale, and a maximum of 5 points will be added for each report and exercise assignment submission, for a total overall course score of up to 100 points.

[Textbooks]

Other, handouts will be distributed

[References, etc.]

（Reference books）

Other, **田坂修二「情報ネットワークの基礎」数理工学社(本体2,300円＋税)** isbn{}{490168311X} isbn{}{9784864810081}

池田、山本「情報ネットワーク工学」オーム社（本体2,800円+税） isbn{}{9784274206283}

[Study outside of class (preparation and review)]

It is desirable that students have mastered the basic concepts of communications technologies.

（Other information (office hours, etc.)）

The order of lectures in the above items may be changed depending on the instructor's circumstances.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 46036 LJ72		
Course title (and course title in English)	マイクロ波工学 Microwave Engineering	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Professor,SHINOHARA NAOKI Research Institute for Sustainable Humanosphere Associate Professor,MITANI TOMOHIKO

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

General concepts,1-2times,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,2-3times,Characteristics of microwave transmission line and circuit theory of transmission line are given. Impedance matching and Smith Chart are given.
Microwave passive circuits,2-3times,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,2-3times,Microwave resonator and filter are given.
Microwave tubes,1-2times,Generation/amplifier mechanism of microwave tubes of Klystron, TWT, magnetron are given.
Micorwave active circuits and semiconductor devices,2-3times,Diode as microwave passive semiconducotor and FET and HBT as microwave active semiconductors are given. Its applications like Parametric amplifier are given.
Microwave Applications,3-4times,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.
Confirmation of Understanding,1time,Student's understanding of this lecture is confirmed. Opportunity of feed-back lecture is given if the studen's understanding is not enough.
The order of instruction for each topic and subtopic may vary, and the
course instructors will organize the lectures as appropriate for the students. Students will be informed of the lecture plan (for all 15 lectures) in advance and will have sufficient time for preparation.

Continue to マイクロ波工学(2)↓↓↓

マイクロ波工学(2)

[Course requirements]

Radio Engineering, Maxwell's equations, theory of radio waves, electric circuits, Distributed parameter circuits

[Evaluation methods and policy]

Grading will be done with the result of the final report and several reports in lectures.

[Textbooks]

Masamitsu Nakajima 『Microwave Engineering (in Japanese)』 （Morikita Publishing）ISBN: 9784627710306

[References, etc.]

（Reference books）

Toshio Nojima and Yasushi Yamao 『RF Circuit Technologies for Mobile COmmunication (in Japanese)』（IEICE）ISBN:9784885522222

Yoshihiro Konishi 『Theory and Applications of Microwave Circuits (in Japanese)』 （Sogo Denshi Publishing）ISBN:4915449599

[Study outside of class (preparation and review)]

A student should read text book before/after class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36037 LJ72		
Course title (and course title in English)	計算機ソフトウェア Computer Software	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KUROHASHI SADAO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course explains the basic data structure and various algorithms
which are indispensable for the creation of various computer programs.

[Course objectives]

This course aims to understand the basic computer program and design it soundly
by mastering the data structure and various algorithms and programming
techniques.

[Course schedule and contents]

[1 week] Algorithm and complexity
What the algorithm is and how to measure the goodness of the algorithm.
[3 weeks] Various data structures and algorithms
List and heap as a basic data structure, and basic algorithms for those structures.
[3 weeks] recursive call and split rule
How to divide and solve complex problems into simpler smaller problems.
[3 weeks] Graph search
The graph structure and its search algorithm.
[2 weeks] Dynamic programming
The principle of optimality and dynamic programming.
[2 weeks] How to measure and cope with difficulty of problems
How to measure the difficulty of the problem itself, how to cope with difficult problems, public key cryptosystem using difficult problems.
[1 week] Confirmation of learning achievement
Review the achievement on the contents of this lecture.

[Course requirements]

It is required to take basic information processing, basic information
processing exercises, exercise of computer programming in EE
engineering (60620), and computer architecture basics (60160).

Continue to 計算機ソフトウェア(2)↓↓↓

計算機ソフトウェア(2)

[Evaluation methods and policy]

Evaluation will be based on assignments and an examination.

[Textbooks]

杉原厚吉『データ構造とアルゴリズム』（共立出版）ISBN:4320120345

[References, etc.]

（Reference books）

Donald E.Knuth 『The Art of Computer Programming Volume 1 Fundamental Algorithms Third Edition **日本語版』（ドワンゴ）**ISBN:9784756144119

[Study outside of class (preparation and review)]

Students should prepare and review the content of the lecture,
focusing on exercise problems given in the lecture and assignments.

（Other information (office hours, etc.)）

For details of office hours, please check with KULASIS.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36039 LJ72		
Course title (and course title in English)	固体電子工学 Solid-State Electronics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NODA SUSUMU Graduate School of Engineering Associate Professor,ASANO TAKASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Overview of solid-state electronics,1time,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?2times,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,4times,We will explain the mechanism of photon absorption in solid state and derive some equations to expess the absorption quantitatively.
Amplification of light,2?3times,We will explain the mechanism of optical amplification and derive some quantitative equations.
Various photonic devices,3?4times,Various photonic devices based on the above discussions are given, such as solar cells, semiconductor lasers, etc.
Verification of understanding,1time,We confirm whether the students can understand the above subjects.

[Course requirements]

It is desirable to learn some related lectures such as semiconductors, fundamental of material and devices, etc.

[Evaluation methods and policy]

Examination and submission of a few reports

Continue to 固体電子工学(2)↓↓↓

固体電子工学(2)

[Textbooks]

Note stile

[References, etc.]

（Reference books）

We will show some references during the lecture

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

The numbers and order of course topics described above might be changed.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26040 LJ72　U-ENG26 26040 LJ52		
Course title (and course title in English)	半導体工学 Semiconductor Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KIMOTO TSUNENOBU

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Introduction to semiconductor engineering,1time,
Semiconductor physics,4-5times,Band structure, carrier statistics, intrinsic/n-type/p-type, current transport (drift, diffusion), mobility, conductivity/resistivity, majority/minority carrier, Hall effect, optical properties, photoconductivity, photovoltaics, high-field effect
Theory of pn junctions,3-4times,metal/semiconductor interface, ohmic and Schottky contacts, space charge, current-voltage characteristics, capacitance-voltage characteristics, generation/recombination, pn junction
Transistors,4-5times,bipolar transistors, MOSFETs
Summary,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Hiroyuki Matsunami: Handoutai kougaku (Shoukoudou) isbn{}{4785612002} isbn{}{4785611308}

Continue to 半導体工学(2)↓↓↓

半導体工学(2)

[References, etc.]

（Reference books）

WILEY S. M. Sze, Kwok K. NG quotquotPhysics of Semiconductor Devicesquotquotisbn{}{ 9780471143239} isbn{}{9780470068304}.

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 36041 LJ52　U-ENG26 36041 LJ59　U-ENG26 36041 LJ77		
Course title (and course title in English)	プラズマ工学 Plasma Engineering	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Associate Professor,EBIHARA YUUSUKE

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Thu.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,2?3times,
,6?8times,
,3?4times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36043 LJ72		
Course title (and course title in English)	電気電子材料学 Electrical and Electronic Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,KOBAYASHI KEI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Wed.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,4times,
,2times,
,2times,
,3times,
,2times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36044 LJ72　U-ENG26 36044 LJ52		
Course title (and course title in English)	光工学 1 Fundamentals of Optical Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KAWAKAMI YOUICHI Graduate School of Engineering Associate Professor,FUNATO MITSURU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Lectures focusing on wave optics, which is an important aspect of study in the field of optoelectronics. Specifically, the fundamental properties of light waves, optical phenomena such as refraction, transmission, reflection, interference, diffraction as well as the analysis of each, and the fundamentals of fourier optics. In addition, the principles of basic optical devices and elements that apply these phenomena will also be covered.

[Course objectives]

Cultivate an understanding of the basic principles of light waves.

[Course schedule and contents]

Overview of optical engineering, 1 session
These sessions will discuss the historical development and engineering significance of this field brought about by the emergence of lasers after providing examples of the relationship between optical engineering and everyday applications of optoelectronics.

Basic properties of light waves, 2-3 session
These sessions will describe the fundamentals of the treatment of light wave propagation in isotropic and anisotropic media based on Maxwell’s equations and explain light wave polarization.

Light wave refraction/transmission/reflection, 3-4 sessions
These sessions will discuss total reflection and optical elements as applications after taking up non-absorbing media and explaining the Snell and Fresnel formulas which form the basis for understanding the phenomena occurring at the boundary between two different media. Lectures will also discuss the behavior of light waves in absorbing media.

Interference and coherence, 3-4 sessions
These sessions will discuss the concept of coherence of light with respect to interference between two light waves as well as the basic concepts guiding the operation of optical devices such as Michelson interferometers, spectrometers, Fabry-Perot optical resonators, and thin-film optical devices using interference phenomena. In addition, the principle of a laser oscillator will be described as one application of optical resonators.

Light wave diffraction, 3-4 sessions
These sessions will introduce the concept of spatial frequency and discuss the treatment of light wave diffraction by Fourier transform based on the fundamental theory of scalar diffraction with specific examples of diffraction images.

Continue to 光工学 1 (2)↓↓↓

光工学１(2)

Confirmation of learning achievement, 1 session
Confirm (evaluate) achievement of the learning objectives of the course.

[Course requirements]

Electromagnetics, Fourier transforms

[Evaluation methods and policy]

On the periodic written evaluations, a passing score is considered to be 60 points or higher.

[Textbooks]

Other, **光工学 (印刷テキスト)** ibid{}{BB02620868}, handouts will be distributed as needed

[References, etc.]

（Reference books）
Other, **現代光科学I（大津元一，朝倉書店）** isbn{}{4254210264},
ヘクト光学I， II（Eugene Hecht**，丸善株式会社）** isbn{}{9784621073483} isbn{}{9784621074480}

[Study outside of class (preparation and review)]

Follow the formulas presented in the lectures and textbooks until the derivation process is understood.
Lectures will highlight the most important areas to understand, so please focus on review.

It is strongly recommended that students try to solve the exercises assigned for each lecture, and not just listen to the explanations only.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46048 LJ72		
Course title (and course title in English)	光通信工学 Optical Communications	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Oki Eiji

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course describes optical fiber communication. Optical networks that use optical communication system are explained. After the course explains optical characteristics and optical transmission, it explains signal propagation in optical fibers, optical signal sources, optical amplifiers, optical elements, and optical modulation and demodulation, considering the differences from conventional electronic communications. Then, the course explains optical networks that adopts optical consummation systems.

[Course objectives]

This course aims to help students to acquire the features of optical communications in comparison with those of electrical communications.

[Course schedule and contents]

Overview, 1 time, progress and present status of optical communications are described as the introduction of the course.
Optical characteristics and optical transmission, 2 times.
Signal propagation in optical fibers, 2 times.
Optical signal sources, 1-2 times.
Optical amplifiers, 2 times.
Optical elements, 2 times.
Optical modulation and demodulation, 1-2 times.
Optical networks, 2-3 times.
Feedback, 1 time.

[Course requirements]

Modulation Theory in Electrical Communication (60320), Information Transmission (60330), Fundamentals of Optical Engineering 1(60440)

[Evaluation methods and policy]

Evaluation will be based on one final examination.

Continue to 光通信工学(2)↓↓↓

光通信工学(2)

[Textbooks]

Not used

[References, etc.]

（Reference books）

Murakami Yasuji: Introduction to Fiber Optic Communication (Corona　Publishing), isbn{}{ 9784339007602}
Hideki Ishio: Optical Communication (Maruzen), isbn{}{9784621081082}
Shinji Yamashita: Guide book for Optical Communication (Gijutsu-Hyohron Co.) isbn{}{4774114367}
Yasuharu Suematu and Kenichi Iga: Introduction to Optical Fiber Communication (4th Edition) (Ohmsha) isbn{}{4274201988}

[Study outside of class (preparation and review)]

Review after class.

（Other information (office hours, etc.)）

Questions can be answered after class. Otherwise, make an appointment by email. For detail office hours, ckeck KULASIS.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

Course number	U-ENG26 46056 LJ72		
Course title (and course title in English)	光電子デバイス工学 Optoelectronic Devices	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NODA SUSUMU Graduate School of Engineering Associate Professor,ASANO TAKASHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

As the foundation for solid-state electronic engineering and semiconductor engineering to be taken by third-year students, detailed discussion is made of the theory of operations of various types of optical and electronic devices. Detailed explanation begins with the fundamentals of operations theory in optical devices.

[Course objectives]

Students will understand the physical background of spontaneous emission processes, as well as various elements essential when considering spontaneous emission processes in semiconductors.

[Course schedule and contents]

Basic light emission processes (4-5 classes)
An overview is made of spontaneous emission processes in two-level electron systems. Explanation is then made of Fermi’s golden rule, electric dipole interactions, density of light (photon) states, etc. Finally, theoretical expression of the light-emitting relaxation rate is derived.

Light emission processes from semiconductors (4-5 classes)
An overview is presented of the processes from energy input to a semiconductor, to light emission. Next, the physics of light-emitting devices are explained.

Using electron-hole state density and distribution functions, etc., theoretical formulas of emission spectra in the steady state are derived. Rate equations describing the transient state are also derived, with explanation of the elements that determine luminous efficiency.

Control of electron state and emission characteristics (4-5 classes)
Light-emission characteristics can be controlled via control of the electron states of a semiconductor light-emitting device. Explanation especially focuses on methods of improving emission characteristics by using quantum structure. Various quantum structures using semiconductor heterostructure are discussed. Explanation is also made of methods of calculating quantization level and of electron devices that use quantum structure.

Confirmation of extent of student learning (1 class)
Confirmation is made of the extent of student learning.

Continue to 光電子デバイス工学(2)↓↓↓

光電子デバイス工学(2)

[Course requirements]

It is desirable that students be taking, or have taken already, solid-state electronic engineering and semiconductor engineering courses.

[Evaluation methods and policy]

Reports (1 or 2 times) and tests.

[Textbooks]

The lecture notes format is used in this course.

[References, etc.]

（Reference books）

Takashi Kushida 『Optical Properties and Spectroscopy of Solids』（Asakura Publishing）ISBN: 4254130511（in Japanese）

Other reference books will be introduced during the course.

[Study outside of class (preparation and review)]

Nothing of note.

（Other information (office hours, etc.)）

Changes may be made in the order of course classes and/or in the time allocated for each topic.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26057 LJ72　U-ENG26 26057 LJ52		
Course title (and course title in English)	光工学２ Fundamentals of Optical Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,FUNATO MITSURU Graduate School of Engineering Professor,KAWAKAMI YOUICHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Lectures covering the basic aspects related to the operational mechanism of the laser, a coherent light wave oscillator, specifically, the amplification of light by sustained emission, the characteristics of optical resonators, analysis of oscillation operation, and finally an overview of various laser devices.

[Course objectives]

Cultivate an understanding of the fundamental operating principles of lasers underpinning the basic concepts of quantum electronics.

[Course schedule and contents]

Overview of laser engineering, 1 session
This session will describe the historical development of quantum electronics and the significance of laser technology, and establish the role of the course.

Basic physics of lasers, 3-4 sessions
These sessions will discuss the interaction between matter and electromagnetic waves, specifically, the theory of absorption, emission, and amplification of light by sustained emission, as a basis for understanding the operation of laser technologies.

Laser operation analysis, 5-6 sessions
These sessions will discuss Q-switched lasers and mode-locking as special examples of laser operation in addition to fostering understanding of laser oscillation conditions and the operation of multi-level systems.

Laser optical resonators and Gaussian beams, 3-4 sessions
These sessions will discuss the various types and characteristics of resonators required for laser oscillators and procedures for the analysis of Gaussian beam propagation as a laser beam.

Laser devices, 1 session
This session will provide an overview of the characteristics of laser devices using various laser media such as gases, liquids, solids, and semiconductors, and also discusses the engineering fields that utilize these characteristics.

Confirmation of learning achievement, 1 session
Confirm (evaluate) achievement of the learning objectives of the course.

Continue to 光工学２(2)↓↓↓

光工学２(2)

[Course requirements]

Optics 1, Electromagnetics

[Evaluation methods and policy]

A report evaluation will be conducted at the end of the term to evaluate students’ level of understanding. A passing score is 60 points or higher out of a possible 100 points. In addition, report tasks will be assigned as needed to improve understanding, but these will not be directly added to a student’s course score.

[Textbooks]

Other, lecture notes, handouts will be distributed as needed

[References, etc.]

（Reference books）

Other, **ヤリフ著 多田,神谷訳：光エレクトロニクスの基礎(丸善)** isbn{}{4621033107}.
ヘクト著 尾崎,朝倉訳：光学III(**丸善**) isbn{}{4621072609}

[Study outside of class (preparation and review)]

Review of course material is recommended as lectures are designed for note-taking.

Lasers are everyday devices. It is hoped that studying topics and areas of practical interest, such as application examples, will help lead to understanding of the basic content of the lecture.

（Other information (office hours, etc.)）

Some lecture contents may be omitted.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 46058 LJ72		
Course title (and course title in English)	電気法規 Laws and Regulations of Electric Power Engineering	Instructor's name, job title, and department of affiliation	Part-time Lecturer,IWANE HIRONORI Part-time Lecturer,SHIMODA KAZUHIKO Graduate School of Engineering Professor,MATSUO TETSUJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Intensive, First semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course discusses the main thrust of electricity-related laws and ordinances, explaining their relationship with energy, environmental problems, and so on, with a focus on the Electric Utility Industry Law.

[Course objectives]

By learning about laws concerning the electricity business, learn details on regulation of energy supply technologies and their safety, and gain the knowledge needed to be certified as an energy supply technician.

[Course schedule and contents]

"1. History of the electricity business and law/electrical equipment technical standards (1 class)

Explain the history of the electricity business and its relationship to various laws and ordinances, the role the electricity business has played, electrical safety, changes in electrical equipment technical standards, the content of regulations, their legal positioning, and so on.

2. Quality of electric power (2 classes)

Explain the quality of electric power and related laws and ordinances, referencing trends in electric power technologies. Also, to accurately understand present conditions in the electricity business and the quality of electric power, take a field trip to an electric power facility.

3. Electric power system applications (1 class)

Explain the electric power system and supply-demand management. Also, discuss the role of electric supply facilities and disaster rehabilitation measures, including a field trip to a facility.

4. Electric power liberalization and nuclear energy (1 class)

Explain challenges related to the electricity business, the trend toward deregulation and liberalization of electric power, and the current state of affairs of nuclear power generation.

5. The global environment and energy conservation/alternative energy (1 class)

Explain global environmental issues such as global warming, as well as electricity business initiatives aiming to achieve a low-carbon society, such as alternative energy, smart grids, and energy conservation.

Continue to 電気法規(2)↓↓↓

電気法規(2)

6. Confirmation of learning attainment (1 class)

Confirm the degree of learning attained with regard to the course overall."

[Course requirements]

Basic information concerning electricity generation, electricity transmission, electricity transformation, and electricity distribution.

[Evaluation methods and policy]

Grade is based on the number of classes attended and score on the examination (administered at the final class meeting).

[Textbooks]

In addition, printouts

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Will be discussed as needed.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A certificate-bearing course that includes practical classes related to the certificate.

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 46059 LJ72		
Course title (and course title in English)	電波法規 Laws and Regulations of Radio Wave Engineering	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Professor,SHINOHARA NAOKI Part-time Lecturer,ASAIMASAMITSU

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/Intensive, Second semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

In recent years, radio wave technology such as satellite communication, cellular phones, wireless LAN, and so on has been remarkably developed. In postwar Japan, radio wave administration is promoted mainly on the basis of the Radio Law and the Broadcast Act. In particular, the Radio Law, which aims to promote public welfare by ensuring the fair and efficient utilization of radio waves (Article 1), fulfills a key role in a society that uses radio waves. This course discusses the establishment of radio wave legislation and basic matters on the Radio Law and its related laws and regulations. This is a required course for those wishing to obtain qualification as the First Class On-The Ground Special Radio Operator or the Third Class Maritime Special Radio Operator.

[Course objectives]

The purpose of this course is to gain an understanding of basic matters concerning the establishment of Japanese radio wave legislation and laws and regulations related to radio waves.

[Course schedule and contents]

Overview of the Radio Law, 1 class: Discuss the foundational principles of the Radio Law, the structure of its provisions, its subjects of regulation, its relationship with international laws, as well as other laws and ordinances, definitions of terms, classification of radio stations, and so on.
History of radio wave legislation, 1 class: Discuss the history of radio wave legislation beginning in the dawn of radio wave technology, postwar hstory of the Radio Law, the Broadcast Act, and the Act for Establishment of Radio Regulatory Commission.
Basic matters on the Radio Law, 10 classes: Licensing and registration of radio stations, reasons for disqualification, licensing procedures, blanket licensing, etc.; Radio operator qualification, radio operator in charge; Technical regulations of radio equipment, Technical Regulations Conformity Certification, Model Examination of Radio Equipment etc. ; Basic principles of radio station operation, retained documents, etc., communication methods, etc.; Supervision, inspection of radio stations, radio propagation blockage prevented area, radio wave usage fees; Overview of related laws and regulations.
On recent law amendments, 1 class: Explain major recent amendments.
Actual operation of radio stations, 2 classes: Explain the actual examples of radio stations such as experimental stations and their related regulations.

[Course requirements]

None

Continue to 電波法規(2)↓↓↓

電波法規(2)

[Evaluation methods and policy]

Attendance in class is required to pass, and grading is based on the results of in-class quizzes.

[Textbooks]

Materials will be distributed.

[References, etc.]

（Reference books）

Shimei Imaizumi 『Radio Law Summary (in Japanese)』（Denki Tsushin Shinko-kai）ISBN: 9784807607693

[Study outside of class (preparation and review)]

No need.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26060 LJ72　U-ENG26 26060 LJ11		
Course title (and course title in English)	ディジタル回路 Digital Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,HASHIMOTO MASANORI Graduate School of Informatics Associate Professor,AWANO HIROMITSU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

From this lecture you can understand basic properties of digital signals and linearized circuits. To understand operating principles, circuit performance, and design method of logic gates and memories.

[Course schedule and contents]

Following topics will be covered. By assessing the understanding of the students and adding explanations and tasks when necessary, we will spend the number of weeks listed in [ ].

(1) Basic properties of digital signals [2 weeks]
,Frequency spectrum of digital signals and step response of linearized ircuit will be explained.

(2) Transmission of digital signals [2 weeks]
Signal transfer characteristics of loss-less transmission lines will be explained. Lossy transmission lines will also be covered.

(3) Switching characteristics of semiconductor devices [3 weeks]
DC and transient characteristics of pn junction diodes, bipolar transistors, MOS transistors will be explained.

(4) Waveform shaping of digital signals [1 week]
Waveform shaping circuits such as a clipper, limiter, and Schmitt-trigger circuits will be explained.

(5) Bipolar digital circuits [2 weeks]
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.

(6) MOS digital circuits [3 weeks]
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.

Continue to ディジタル回路(2)↓↓↓

ディジタル回路(2)

(7) MOS memory circuits [1 week]
Circuit configuration of ROM and RAM will be explained.

(8) Confirmation of understanding [1 week]
The level of understanding on this lecture will be confirmed. Feedback will be given if necessary.

[Course requirements]

Semiconductor Engineering, Logic Circuits, Electronic Circuits

[Evaluation methods and policy]

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

[Textbooks]

Hand-outs will be provided.

[References, etc.]

（Reference books）
Introduced during class

[Study outside of class (preparation and review)]

Plactices in the handout should be solved after the corresponding topic is covered by the lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36061 LJ72				
Course title (and course title in English)	ディジタル信号処理 Digital Signal Processing	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,NOBUHARA SHOUHEI Graduate School of Informatics Professor,NISHINO KO		
Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The goal of this lecture is to understand fundamental theories and filter designs for one-dimensional time-domain signal and two-dimensional image processing and encoding. In particular, this course provides introductions to orthogonal transformation such as discrete Fourier transform, fast Fourier transform algorithms, one-dimensional and two-dimensional signal encoding methods including basics of JPEG / MPEG, and FIR and IIR filters based on the discrete-time linear time invariant system theory

[Course objectives]

Digital signal processing requires both theoretical analysis / design and practical software system implementations. This course provides exercises on signal processing in Python, with guidance by teaching assistants, and additional resources via the course web site. Short questions and answers are also provided to help understand the theories and implementations.

[Course schedule and contents]

Overview of digital signal processing (2 classes)
* Introduction of the goal of digital signal processing, its essential ideas and advantages.
* Extension of 1D Fourier transform to 2D or multi-dimensional signals and its applications in computed tomography (CT).

Sampling and quantization (1 class)
* Sampling theories in 1D signals and digitization process of 2D images.

Discrete Fourier transform and FFT (3 classes)
* Discrete Fourier transform in 1D signals.
* Fast Fourier transform and its extension to 2D image signals.

Orthogonal transformation and short-time Fourier transform (3 classes)
* Discrete cosine transform and digital signal processing based on orthogonal transformation.
* Short-time Fourier transform.
* Multi-scale signal analysis and its extension to wavelet transform.

Encoding (2 classes)
* Waveform coding, vector quantization, and transform coding.
* Media encoding for audio, document images, images (JPEG) and videos (MPEG).

Filtering based on discrete-time systems (3 classes)
* Discrete-time linear time-invariant system and z transform.

Continue to ディジタル信号処理(2)↓↓↓

ディジタル信号処理(2)

* FIR and IIR filters
* Basics on linear phase FIR filter and IIR filter design.
* Filtering of 2D image signals.

[Course requirements]

Industrial Mathematics E1 (20540) and Fundamental Communication Theory (60320) are prerequisites for this course. Students should take Digital Control (60270) in parallel.

[Evaluation methods and policy]

Grade evaluations will be based fundamentally on scores in the written final test. Evaluation will also be provided for the development of “non-trivial” digital processing software and reports on the functions, designs, performance evaluations, etc., of the software.

[Textbooks]

Instructed during class

[References, etc.]

（Reference books）

Allen B. Downey 『Think DSP: Digital Signal Processing in Python』（O'Reilly Media）ISBN:1491938455
（Online versions are available at http://greenteapress.com/wp/think-dsp/）

（Related URLs）

http://greenteapress.com/wp/think-dsp/(An online version of "Think DSP")

[Study outside of class (preparation and review)]

Students should improve programming skills in Python through digital signal processing exercises provided in the lecture.

（Other information (office hours, etc.)）

Students should bring their own laptop for exercises in Python.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26062 SJ72　U-ENG26 26062 SJ11		
Course title (and course title in English)	電気電子プログラミング及演習 Exercise of Computer Programming in Electrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KUROHASHI SADAO Graduate School of Informatics Associate Professor,NOBUHARA SHOUHEI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.4,5	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Introduction (1 class)
Introduction of the importance and contributions of computer programming, followed by some instructions on weekly reports and a final project.

Prerequisites of Programming (3 classes)
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 classes)
Arrays, multi-dimensional arrays, functions, scopes, bit-operations, recursive calls.

Advanced Programming (3 classes)
Strings in C and their representations inside the computer, pointers, structures, file I/Os.

Final Project (4 classes)
A final project of this year.

[Course requirements]

"Exercises in Information Processing Basics" (basic skills on using UNIX-like systems) will be necessary.

For weekly assignments and the final project, one will need to bring your own laptop PC (Windows, macOS, Linux) at every class. Students are encouraged to install the programming environment by following the instructions available at PandA before the 1st week of the course.

Continue to 電気電子プログラミング及演習(2)↓↓↓

電気電子プログラミング及演習(2)

[Evaluation methods and policy]

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

[Textbooks]

Bohyoh Shibata 『Meikai C Gengo Nyuumon-hen』ISBN:9784797377026（in Japanese）

[References, etc.]

（Reference books）

Chinese (ISBN: 9789862010426) and Korean (ISBN: 9788991767447) translations of the textbook are available.

（Related URLs）

https://panda.ecs.kyoto-u.ac.jp(Select "2019 Exercise of Computer Programming in Electrical and Electronic Engineering")

[Study outside of class (preparation and review)]

The course can cover only the essential points in programming. Students are encouraged to study by themselves with the textbook.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 16063 LJ72		
Course title (and course title in English)	電気回路基礎論 Fundamentals of Circuit Theory	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,HISAKADO TAKASHI

Target year	1st year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The course introduces the fundamentals of the electric circuit. Topics covered include: resitive elemnts and networks; independent sources; switches and dynamics of first- and second-order networks; phasor analysis; 2-port circuits.

[Course objectives]

Students are expected to learn the transient analysis by differential equation and steady state analysis by phasor.

[Course schedule and contents]

DC circuit,3times,We introduce Kirchhoff#039s current law and Kirchhoff#039s voltage law, Ohm#039s law and independent sources.
Differential equation of circuit,5times,We introduce inductors and capacitors and explain the differential equation of circuit.
AC circuit,4times,We introduce phasor and explain the steady state analysis.
two-port circuit,2times,We extend one-port elements to two-port circuits.
academic achievement test,1time,The level of understanding on this lecture will be confirmed.

[Course requirements]

None

[Evaluation methods and policy]

Reports and examinations

[Textbooks]

奥村浩士 『エース電気回路理論入門』（朝倉書店）ISBN:4254227469

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

After the lesson, solve problems in the text.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36066 LJ72		
Course title (and course title in English)	システム最適化 System Optimization	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SAKAMOTO TAKUYA

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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

[Course schedule and contents]

Optimization problems,1time,optimality, overview and classification of optimization problems, mathematical preliminary
Linear programming and simplex method,7-8times,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,1time,definition of nonlinear programming problems, locally optimal solution and globally optimal solution, convex space and convex function, mathematical preliminary
Solution methods for nonlinear programming problems without constraints,2-3times,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,2-3times,optimality conditions for nonlinear programming problems with constraints, Lagrange function, Lagrange multiplier method, duality, saddle point theorem, penalty function method, multiplier method, and sequential quadratic programming method
Review,1time,The level of understanding on this lecture will be confirmed.

[Course requirements]

linear algebra and analytics

[Evaluation methods and policy]

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

Continue to システム最適化(2)↓↓↓

システム最適化(2)

[Textbooks]

H. Tamaki (ed.): System Optimization (in Japanese), Ohm-sha, 2005 isbn{}{4274201627}.

[References, etc.]

（Reference books）

M. Fukushima: Introduction to Mathematical Programming (in Japanese), Asakura, 1996 isbn{}{9784254209754} isbn{}{9784254280043}.

（Related URLs）

(http://turbine.kuee.kyoto-u.ac.jp/~furutani/system-optimization/)

[Study outside of class (preparation and review)]

Will be discussed as needed.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36072 LJ72		
Course title (and course title in English)	パワーエレクトロニクス Power Electronics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HIKIHARA TAKASHI Graduate School of Engineering Assistant Professor,MOCHIYAMA SHIU Part-time Lecturer,CASTELLAZZI, Alberto

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

Students are expected to learn the method of power conversion and its applications based on circuit theory, switching circuit, and semiconductor engineering. They are also requested to understand the method for achieving the functions of actuators through the control of electric power convertor.

[Course schedule and contents]

Outline of power electronics,4times,Introduction of power electronics. Fundamental topics of LRC circuit based on stored energy and power and switching circuit are lectured . The lecture will be interconnected with semiconductor engineering.
dc/dc convertors,4times,The dynamic behavior and characteristics of Buck and Boost converters are explained.
ac/dc convertors,4times,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,2times,As the applications of power electronics, the motor drive by inverters are lectured.
Summary,1time,The classes are summarized. This is the feedback to students according to their score.

[Course requirements]

Electric circuit, Electronic circuit, Power circuit, and Electric apparatus.

[Evaluation methods and policy]

The final evaluation is decided based on examination wit homeworks.

[Textbooks]

Lecture notes will be posted at the web page.

[References, etc.]

（Reference books）

There are many supplemental texts. If students request their English version, please contact to the professor.

Continue to パワーエレクトロニクス(2)↓↓↓

パワーエレクトロニクス(2)

（Related URLs）

(Lecture data are offered on kulasis or Panda.)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Students are recommended to download the note from home page and study them before the classes. If you miss one of the mid and final exam, it becomes too hard to pass this class. Taking the follow-up lecture will be requested to the students who is difficult to pass the requested level.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 16074 LJ72		
Course title (and course title in English)	電気電子工学概論 Introducion to Elecrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,YOSUKE ITOH Graduate School of Engineering Associate Professor,OKAMOTO RYOU Graduate School of Informatics Senior Lecturer,MURAWAKI YUGO Research Institute for Sustainable Humanosphere Associate Professor,YOKOYAMA TATSUHIRO

Target year	1st year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Wed.4,5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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 the first time 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.

[Course objectives]

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 schedule and contents]

Overview (1 time):
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 laboratory A (1 time):
Each team visits the assigned laboratory A that belongs to the Electric and Electronic Engineering Course, and investigates the activities in the lab.

Visiting laboratory B (2 times):
Each team visits the assigned laboratory B that belongs to the Electric and Electronic Engineering Course, and investigates the activities in the lab.

Preparation of presentation (2 times):

Continue to 電気電子工学概論(2)↓↓↓

電気電子工学概論(2)

The students prepare a poster presentation to introduce the activities in the laboratory B that they visit and investigate.

Presentation (1 time):
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.

[Course requirements]

None

[Evaluation methods and policy]

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.

[Textbooks]

The materials will be distributed.

[References, etc.]

（Reference books）

The materials will be distributed.

[Study outside of class (preparation and review)]

A report should be prepared before visiting each laboratory. The student should summarize three keywords related to each laboratory. The three keywords will be announced at Overview.

（Other information (office hours, etc.)）

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.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26080 SJ72		
Course title (and course title in English)	電気電子計算工学及演習 Computational Methods and Exercise in Electrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,AMEMIYA NAOYUKI Research Institute for Sustainable Humanosphere Associate Professor,EBIHARA YUUSUKE Research Institute for Sustainable Humanosphere Associate Professor,YOKOYAMA TATSUHIRO Graduate School of Engineering Senior Lecturer,MIFUNE TAKESHI Graduate School of Informatics Senior Lecturer,MURAWAKI YUGO

Target year	3rd year students or above	Number of credits	3	Year/semesters	2022/Second semester
Days and periods	Thu.1,2	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

This course introduces the students the fundamentals of numerical analysis required for electrical and electronic engineering. In addition, the course offers exercises to develop the skills in computer programming to solve the related problems.

[Course objectives]

Students are expected to understand the fundamental cocept as well as the background of numerical analyses in electrical and electronic engineering.
They are expected to obtain programing skill and knowledge to carry out various numerical analsyes.

[Course schedule and contents]

Numerical expression and errors in computer ,1?2 times,
Solution of linear equation,2?3 times,
Solution of nonlinear equation,2?3 times,
Solution of eigenvalue problem,1~2times,
Interpolation and numerical Integration,2?3 times,
Solution of ordinal differential equation,2?3 times,
Solution of partial differential equation,2?3times,
Interview,1time,

[Course requirements]

Linear algebra
precalculus

[Evaluation methods and policy]

Grading will be made based on reports, interview, attendance to the class, and several quizzes.

Continue to 電気電子計算工学及演習(2)↓↓↓

電気電子計算工学及演習(2)

[Textbooks]

Instructed during class

[References, etc.]

（Reference books）

Introduced during class

[Study outside of class (preparation and review)]

Students are expected to study on exercise problems at home.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 36081 LJ72		
Course title (and course title in English)	電気電子工学のための量子論 Theory of Quantum for Electrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKEUCHI SHIGEKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Quantum mechanics describes the behavior of electrons and photons and forms the foundation of natural law. It is also essential for understanding current electronic devices and various advanced quantum technologies such as quantum computers and quantum cryptography. In this lecture, we explain basic matters on quantum mechanics. After discussing the collapse of classical mechanics and old quantum theory, the Schrödinger equation and some solutions will be explained. After that, we discuss the general properties of the wave function and the uncertainty principle. In addition, the basics of quantum information science will be overviewed.

[Course objectives]

To grasp the physical image of the behavior of quanta. Specifically, we aim to understand fundamental concepts of quantum mechanics such as superposition state, uncertainty principle, quantum entanglement, etc. and to be able to perform some basic calculations using wave functions.

[Course schedule and contents]

1. Overview and old quantum theory (2〜3times)
After describing general features and applications of quantum mechanics, we explain the collapse of classical mechanics and the old quantum theory.

2. Schroedinger equation (4〜6times)
We introduce the Schrödinger equation and discuss its eigenvalue problems of two dimensional and three dimensional potential well.

3. Dynamics of quanta (1〜2 times)
We discuss the dynamics of quanta using time evolution operator.

4. General properties of wave functions (3〜4times)
In order to discuss the general properties of wave functions, we introduce a complex linear space (Hilbert space) and explain orthogonality of wave functions and operators. In addition, the uncertainty principle will be discussed.

5. Basics of quantum information technology (1〜2times)
The basics of quantum information technology is overviewed.

Continue to 電気電子工学のための量子論(2)↓↓↓

電気電子工学のための量子論(2)

[Course requirements]

Basic knowledge of linear algebra, Fourier analysis, differential equation, dynamics, electromagnetism.

[Evaluation methods and policy]

Evaluate (From 0 to 100 points) comprehensively by regular test (60%), quizzes during lectures(20%), and some reports(20%). The submission of the reports are in principle mandatory.

[Textbooks]

Official textbook is not assigned.

[References, etc.]

（Reference books）

Some textbooks for reference will be introduced during the lecture.

[Study outside of class (preparation and review)]

Preliminary review and review are indispensable. Some report tasks will be given (mandatory).

（Other information (office hours, etc.)）

Depending on the progress situation, the order of lecture items may be changed or some may be omitted.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course
The professor have been involved in the research of quantum information technology at a company.

(3) Details of practical classes delivered based on instructors’ practical work experience
In this lecture, how quantum theory has been used in society will be discussed.

未更新

Course number	U-ENG26 26101 LJ72		
Course title (and course title in English)	電気電子計測 Electric and Electronic Measurement	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,OKAMOTO RYOU

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The basics of the measurement of electrical and magnetic quantities will be explained. First we describe the general theory of the measurement, to explain the principles of the various measurement methods and measuring instrument on the amount of electricity. In addition, as electrical and electronic application measurement, optical measurement will be overviewed.

[Course objectives]

Understand the basics of the electrical and electronic measurements.

[Course schedule and contents]

Standards and traceability,2times,The general theory of the measurement, the unit system, outlined of measurement standards and traceability.
Error and evaluation of the measurement data,2～3times,The concept of error and uncertainty, as well as the basic evaluation method of measurement data such as regression analysis
Analogampdigital signal processing,2～3times,Amplification circuit using an operational amplifier (OA), DA and AD conversion, and Fourier transform.
measurement technologies for electrical quantities,5?6times,The most basic is to explain the principles of the instruction type electric instrument, described voltage, current, power, the electrical quantities of the measurement method of the power factor and the like. In addition, measures for small voltage measurement and noise, also mentioned for measurement of the frequency domain.
Applied electric electronic measurements,1?2times,For example, optical measurements.
Confirmation of learning achievement,1time,Confirmation of learning achievements on electric and electronic measurements.

[Course requirements]

Electromagnetism, electrical and electronic circuits, mechanics

[Evaluation methods and policy]

The result of the final test, the results of tests at each lecture, and some reports will be taken into account for the total evaluation.

Continue to 電気電子計測(2)↓↓↓

電気電子計測(2)

[Textbooks]

Kohro Yamazaki, Denki-denshi-keisoku-no-kiso (The institute of electrical engineers of Japan) isbn{}{ 4886862489}

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Review with handouts is desired.

（Other information (office hours, etc.)）

Some topics may be skipped or swapped according to the progress of the lecture.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 26102 LE72		
Course title (and course title in English)	電気電子数学1 Mathematics for Electrical and Electronic Engineering 1	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Professor,OOMURA YOSHIHARU Graduate School of Engineering Professor,DOI SHINJI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Fri.1	Class style	Lecture	Language of instruction	English

[Overview and purpose of the course]

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.

[Course objectives]

We learn mathematical methods to describe spatial and temporal evolutions of various physical phenomena.

[Course schedule and contents]

Classification of Partial Differential Equations,2times,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,2times,Series solutions by Frobenius' method; trigonometric, Bessel, and Legendre functions. Singular points for ODE; Wronskian; linear independence of solutions; second solution
Sturn-Liouville Theory,1time,Self-ajoint ODE; Hermitian operator; Sturm-Liouville theory
Green's Function Method,1time,Green's function method to solve nonhomogeneous equations.
Bessel Functions,2times,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,1time,Legendre functions; generating functions; boundary value problems; associated Legendre polynomials.
Fourier Series,1time,Properties of Fourier Series, Gibbs Phenomenon
Fourier Transform,2times,Fourier integral, Fourier transforms of Gausian and derivatives, Dirac delta function, Solutions of wave equation and diffusion equation
Laplace Transform,2times,Laplace transform, inverse Laplace transform, initial value problems of ODE
Confirmatin of Understanding,1time,The level of understanding on all topics covered by this lecture will be confirmed through by the term examination.

[Course requirements]

Calculus, Vector Analysis, Functions of Complex Variable, and English comprehension of the level of VOA Special English

[Evaluation methods and policy]

The grade will be given by adding all points of reports (5points x 13times) and a term examination(100points). A grade grater than or equal to 60 is successful. If the total point exceeds 100, the

Continue to 電気電子数学1(2)↓↓↓

電気電子数学1(2)

grade is given as 100.

[Textbooks]

Mathematical Methods for Physicists: A Comprehensive Guide, Seventh Edition, Arfken, Weber, and Harris isbn{}{9780123846549} (Kindle version is available.)

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Try to read chapters of the textbook based on the lecture notes.

（Other information (office hours, etc.)）

Lectures are given mostly in English.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36103 LJ72		
Course title (and course title in English)	電気電子数学２ Mathematics for Electrical and Electronic Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,DOI SHINJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Transformation and approximation of data (signals) are basic tasks of any science or technology. Also, conceptions of linear space and linear mapping are the basis of not only such signal processing but of a number of engineering theories. Thus, this course discusses mainly signal theory and function approximation problems, explaining linear algebraic and functional analytic concepts and their engineering applications. Students learn the mathematical techniques needed in electrical and electronic engineering, specifically the concepts of linear space, functional analysis, and signal theory. Through this course, students not only learn the foundations of numerous subjects such as basic communications theory, control engineering, and signal/ image processing, they also gain an expanded perspective from which they can look out on a number of different subjects.

[Course objectives]

Learn the mathematical techniques needed for electrical and electronic engineering, specifically the concepts of linear space, functional analysis, and signal theory.

[Course schedule and contents]

Linear space and linear mapping, 3-4 classes: Review linear algebra, explaining not only linear space in terms of matrix calculation but also describing the concepts of linear space and linear mapping. Describe expression on the basis of data (vectors) and its relation to eigenvalue problems, as well as the relationship between eigenvalue problems, on the one hand, and variation problems (minimax problems) and least squares approximation problems on the other, and explain the importance of linear algebraic concepts.
Abstract space/signal space, 2-4 classes: Explain not only finite dimensional vectors, but also functional spaces with elements (vectors) of infinite dimensional signals/functions. Introduce metric spaces, and describe convergence, Cauchy sequences, and completeness within them. Also, introduce norms in linear space, norm spaces, and inner product spaces, and describe the properties of these spaces. Introduce examples of functional spaces, and describe convergence and completeness. Also, describe mapping (operators), projection, orthogonality, and orthogonalization in functional spaces, and again explain the importance of linear algebraic concepts.
From abstract space to continuous/discrete signals, 2-3 classes: Introduce specific function systems as the bases of functional spaces. Explain the functional systems used frequently in analog and digital signal processing such as trigonometric functional systems and Haar functional systems. Also, describe how the polynomial systems of Legendre, Laguerre, and Hermite seen in Electrical and Electronic Mathematics 1 and Quantum Mechanics are produced by the orthogonalization of functions.
Continuous/discrete signal transformation (basic), 2-3 classes: Discuss function expansion in terms of system and signal notation methods. Explain general Fourier series as an expansion upon trigonometric functional systems, and discuss application of continuous and discrete signals to least squares approximation problems.
Continuous/discrete signal transformation (applied), 2-4 classes: Explain the various application methods

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電気電子数学２(2)

used in system engineering and signal processing. Describe the discrete Fourier transform, wavelet expansion, and the finite element method in terms of the functional expansion by non-orthogonal (and a finite number of) functions.
Confirmation of learning attainment, 1 class: Confirm the degree of learning attained with respect to the above subjects.

[Course requirements]

Linear algebra, calculus

[Evaluation methods and policy]

Final examination + report assignments

[Textbooks]

Not used

[References, etc.]

（Reference books）
J.P.Keener『Principles of Applied Mathematics』（Westview Press）（Japanase translation: **キーナー応用数学**, **上下，日本評論社**）

[Study outside of class (preparation and review)]

Review handouts and example solutions of problems provided in the class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 46104 LJ72		
Course title (and course title in English)	電気伝導 Electrical Conduction in Condensed Matter	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,DOI TOSHIYA Graduate School of Engineering Associate Professor,KAKEYA ITSUHIRO

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

(1) Fundamentals of quantum mechanics, and the hydrogen atom model (2 classes)
A simple review is made of quantum mechanics, and explication is made of electron states (energy, spatial distribution, etc.) within hydrogen and atoms other than hydrogen.

(2) Free-electron Fermi gas (3 classes)
Explanation is made of the free-electron model as an ideal Fermi gas. Then, an overall explanation is provided of conductivity in metals, electronic specific heat, and the Hall effect.

(3) Energy bands (2 classes)
The band structure of electron energy within a solid crystal is introduced, and explanation is provided of conductivity and the band structures of conductors, semiconductors, and insulators.

(4) Electron-phonon interactions, and conductivity in metals and semiconductors (4 classes)
Lattice vibration is explained via quantized phonons (Bose particles) and Bose statistics, and lattice specific heat is introduced via determination of phonon density of state. Phonon scattering and electron scattering are explained. On this basis, explanation is then provided regarding the heat dependent nature of resistivity in metals, as well as of the Bloch-Gr#252neisen law at low temperature. Conductivity in semiconductors, especially scattering, is also explained.

(5) Superconductivity (3 classes)
With respect to superconductive phenomena, explanation is made, using the London equation, of the Meissner effect, etc. Overview explanation is made of the Ginzburg-Landau theory, and order parameters are introduced. The relationship between phase and vector potential, important for superconductivity, is

Continue to 電気伝導(2)↓↓↓

電気伝導(2)

explained, as well as the Josephson effect. Explained also is magnetic flux quantization within type II (high field) superconductors.

(6) Feedback lesson (1 class)
Confirmation of learned content is made based on evaluations of short tests and the score on the final examination, etc.

[Course requirements]

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.

[Evaluation methods and policy]

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

[Textbooks]

C. Kittel 『Introduction to Solid State Physics, 8th ed.』 （Wiley）ISBN:0471680575

[References, etc.]

（Reference books）
田沼静一 『電子伝導の物理』（裳華房）ISBN:4785329149
Ashcroft-Mermin 『Solid State Physics』ISBN:0030839939
鈴木実 『固体物性と電気伝導』（森北出版）ISBN:9784627156012
矢口裕之 『初歩から学ぶ固体物理学 (ＫＳ物理専門書)』ISBN:4563024082

（Related URLs）

(Students will be notified of this within class as soon as it is made available, as intended.)

[Study outside of class (preparation and review)]

Preparing before classes and reviewing after classes are recommended.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36105 LJ72		
Course title (and course title in English)	電気機器基礎論 Electric Machinerys Fundamentals	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,SHIRAI YASUYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Fundamental theory of electro-magnetic energy conversion, fundamental configuration and characteristics of transformer, induction rotating machine, synchronous rotating machine and direct current rotating machine are lectured.

[Course objectives]

Master the fundamentals of various types of electric machinery

[Course schedule and contents]

General Introduction,1-2times,History of electro-magnetic energy conversion and electric machinery
Electro-magnetic energy conversion,3-4times,fundamental theory of electro-magnetic energy conversion
basic characteristics of electric machinery,8-9times,basic characteristics and configuration, equivalent circuit of various types of electric machinery
general theory of rotating mahine,1time,general expression of electric machinery for dynamic performance analysis
Evaluation of achievement,1time,Exercise

[Course requirements]

Electric Circuits, Electromagnetic Theory 1

[Evaluation methods and policy]

mini-exercises in class and regular exam

[Textbooks]

quotElectric Machineryquot,Ohm University Text Series, Ed. Yasuyuki Shirai, Ohm-sya (in Japanese) isbn{}{4274216770}

[References, etc.]

（Reference books）

Electric machinery (1),(2) Ed. Sakutaro Nonaka, Morikita Syuppan (in Japanese) ISBN 4627720106 isbn{}{4627720106}
Electric machinery (1),(2) Ed. Takao Okada, Ohm-Sya (in Japanese) ISBN 4274128970 isbn{}{4274128970}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Office hour : Monday 12:00-13:00

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36106 LJ72		
Course title (and course title in English)	応用電気機器 Applied Electric Machinery	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Program-Specific Professor,NAKAMURA TAKETSUNE

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

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 schedule and contents]

Concept of output power and fundamental aspects of design in electric machineries,2-3times,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,1-2times,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,6-8times,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,1-2times,Power conversion method for the realization of variable speed control is explained.
Permanent magnet rotating machines,1time,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,1time,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.
Summary,1time,The classes are summarized. This is the feedback to students according to their score.

Continue to 応用電気機器(2)↓↓↓

応用電気機器(2)

[Course requirements]

Electric Circuits, Electromagnetic Theory, Power Electronics, Control Theory

[Evaluation methods and policy]

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

[Textbooks]

Tokai Kim, quotModern electric machineryquot Denki-gakkai isbn{}{9784886862808}

[References, etc.]

（Reference books）

Takao Okada et al., quotElectric machinery (2)quot(second edition) Ohmsha isbn{}{4274130088},
Sakutarou Nonaka, quotElectric machinery (1), (2)quot Morikita-shuppan isbn{}{4627720106}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Documents will be distributed if necessary.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36109 LJ72		
Course title (and course title in English)	電波工学 Radio Engineering	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Professor,SHINOHARA NAOKI Research Institute for Sustainable Humanosphere Professor,HASHIGUCHI HIROYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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.

[Course objectives]

Understand the basic theory of the radio wave, and technology for its industrial applications.

[Course schedule and contents]

Nature of the radio wave,2-3times,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,4-5times,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,2-3times,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,4-5times,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.
The order of instruction for each topic and subtopic may vary, and the
course instructors will organize the lectures as appropriate for the students. Students will be informed of the lecture plan (for all 15 lectures) in advance and will have sufficient time for preparation.

Continue to 電波工学(2)↓↓↓

電波工学(2)

[Course requirements]

Knowledge of Electromagnetic theory 2 is required. Modulation Theory in Electrical Communication is recommended.

[Evaluation methods and policy]

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

[Textbooks]

Hasebe Nozomu 『Denpa kogaku (radio engineering); 2nd Ed. (in Japanese)』 （Corona publishing）ISBN: 978-4-339-00773-2

[References, etc.]

（Reference books）

Balanis 『Antenna theory, 2nd Ed.』 （Wiley）ISBN:0471592684

[Study outside of class (preparation and review)]

A student should read text book before/after class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 46110 LJ72		
Course title (and course title in English)	アンテナ・伝搬工学 Antenna and Propagation Engineering	Instructor's name, job title, and department of affiliation	Research Institute for Sustainable Humanosphere Professor,YAMAMOTO MAMORU Research Institute for Sustainable Humanosphere Professor,HASHIGUCHI HIROYUKI

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

In this course, students learn about various types of electromagnetic field analysis techniques and antenna pattern synthesis theory used in characteristic analysis and design of antenna. Then, an overview of radio application technologies (radio-wave propagation, different types of radar, etc.) is presented, as well as a look at the current situation regarding these technologies.

[Course objectives]

Based on a knowledge of radio engineering, students will gain a higher level of understanding of electromagnetic-wave concepts and of specific technologies in which electromagnetic waves are used.

[Course schedule and contents]

Pattern synthesis for array antenna (2-3 classes)
Students learn the fundamentals of optimal pattern synthesis theory used to improve array antenna gain and to suppress sidelobes. Taken up especially are Dolph-Thebysheff and Taylor methods. Students also learn about adaptive array technology.

Fundamentals of electromagnetic field analysis (3-4 classes)
Explained are the principles and characteristics of various methods used to determine electromagnetic fields radiating from antennas and dynamic impedance, including the finite element method (FEM), electromotive force method, method of moments, physical optics method, finite-difference time-domain (FDTD) method, etc.

Radio wave propagation (2-3 classes)
Explained are fading in wireless communications, propagation in outer space communications, remote sensing applications, etc.

Radar technology (2-3 classes)
Explanation is made of principles of measuring distance and speed using radar, and of element technologies including pulse compression method, etc. Discussion also covers the principles and signal processing methods of example applications of radar technologies, including meteorological radar, atmospheric radar, and synthetic aperture radar.

Radio navigation (1-2 classes)
Explanation is made of the principles of technologies for measuring the positions/locations of ships and aircraft, etc., by using radio waves. Discussion also covers an overview and applications of radio navigation methods, as represented by the global positioning system (GPS).

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アンテナ・伝搬工学(2)

Confirmation of extent of student learning (1 class)
Confirmation (evaluation) is made of the extent that students have learned the contents of this course.

[Course requirements]

Students are required to be taking or to have taken a course in radio engineering.

[Evaluation methods and policy]

Grading method
Scores on regular tests (80%) Student performance in classes (20%)

Grading standards
The following grades are given in accordance with the goal-achievement levels of each individual student:
A+: Course goals have been accomplished at an extremely high level, from all perspectives.
A: Course goals have been accomplished at a high level, from all perspectives.
B: Course goals have been accomplished, from all perspectives.
C: Confirmation can be made, from a majority of perspectives, of effects of student learning, and course goals have been accomplished to a certain extent.
D: While course goals have been accomplished to a certain extent, further effort by the student is desirable.
F: No confirmation can be made of effects of student learning, and it is difficult to say that a student has accomplished the goals of this class.

[Textbooks]

長谷部 『電波工学』（コロナ社）ISBN:4339007730

[References, etc.]

（Reference books）
新井 『新アンテナ工学』（総合電子出版社）ISBN:4915449807
山口他 『電気電子計測』（オーム社）ISBN:4274128733
前田・木村 『現代 電磁波動論』（オーム社）ISBN:4274128024
高野他 『宇宙における電波計測と電波航法』（コロナ社）ISBN:4339012211

[Study outside of class (preparation and review)]

Students should prepare and review the contents as instructed during each class period.

（Other information (office hours, etc.)）

No specific office hours have been set. When you want to talk directly, please first contact us by e-mail of your intention to either of the following e-mail addresses.

Prof. Yamamoto (yamamoto@rish.kyoto-u.ac.jp)
Prof. Hashiguchi (hasiguti@rish.kyoto-u.ac.jp)

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36111 LJ72		
Course title (and course title in English)	組み込み計算機システム Embedded Computer Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,SATOU TAKASHI Graduate School of Informatics Associate Professor,AWANO HIROMITSU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Wed.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture covers basics of embedded systems. Processor architectures, memory subsystems, I/O systems, and overall system architectures in embedded systems will be explained.

[Course objectives]

To understand basic structures of embedded computer systems. To understand impacts of architectural design choices on performance and energy consumption of embedded systems.

[Course schedule and contents]

Basic properties of computer systems (1 week): History of embedded computer systems.
Cache memory (3 weeks): Cache architectures, data transfer between main memory and cache.
Compiler optimization (1 week): A role of compilers in computer systems and performance tuning by code optimization.
Main memory virtualization (2 weeks): Effective use of main memory and secondary memory, memory virtulization, and address conversion.
Operating system and interrupt (2 weeks): The concept of interrupt, interrupt handling, and necessary hardware supports for the interrupt will be explained. Relation between operating systems and the interrupt, and time overhead for the interrupt will be explained.
Instruction pipeline (2 weeks): The concept of instruction pipelining, necessary mechanisms for the pipelining, and characteristics of RISC processors.
Instruction formats and addressing modes (2 weeks): Formats and addressing modes of typical instructions.
Trends in embedded systems (1 week): Recent trends on embedded computer architectures such as multi-core processors.
Review (1 week): The review of understanding on this lecture.

[Course requirements]

logic circuits (60120), computer architecture basics (60160)

[Evaluation methods and policy]

The level of achievement toward the goal of this lecture will be examined by the end-of-term exam.

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組み込み計算機システム(2)

[Textbooks]

The course will loosely follow "Computer Organization and Design: The Hardware/Software Interface" by patterson and hennessy. Having an access to a copy is strongly recommended.

[References, etc.]

（Reference books）

David Patterson and John Hennessy 『Computer Organization and Design: The Hardware/Software Interface』

[Study outside of class (preparation and review)]

Homework will be assigned. Deepen understanding through solving the homework and through reading textbooks.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46113 LJ72　U-ENG26 46113 LJ11		
Course title (and course title in English)	集積回路工学 Integraged Circuits Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,SATOU TAKASHI Graduate School of Informatics Professor,HASHIMOTO MASANORI Graduate School of Informatics Associate Professor,AWANO HIROMITSU

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture explains design methodologies for CMOS LSI circuits. Both analog and digital circuits will be covered.

[Course objectives]

From this lecture, you can understand design flow of CMOS LSI circuits.

[Course schedule and contents]

Following topics will be covered. By assessing the understanding of the students and adding explanations and tasks when necessary, we will spend the number of weeks listed in [ ].

(1) CMOS process and devices [2 weeks]
Overview of CMOS process technology related to LSI circuit design will be explained. Structures, characteristics and modeling methods for MOS transistors, capacitors, inductors and interconnects will be also explained.

(2) Analog circuit design [2 weeks]
Architecture and behavior of basic analog circuits such as constant current source and current mirror amplifier will be explained. Design methods for op-amps will be explained.

(3) Digital circuit design [4 weeks]
Design methodologies for combinational and sequential circuits are explained. Hardware algorithms for alithmetic logic unit will be discussed.

(4) Evaluation and optimization of digital circuits [2 weeks]
Methodologies for evaluating and optimizing the power consumption and delay of circuits are explained. Test methods will be also explained.

(5) Full custom layout design [2 weeks]
Design rules and layout verification methods will be explained. Full-custom layout design methods for analog circuits and basic logic gates are explained. Design methodologies for ROM and RAM will be explained.

(6) Chip level layout design [2 weeks]
Layout design methods and chip-level assembly methods in a cell-based design flow will be explained.

(7) Confirmation of understanding [1 week]
The level of understanding will be confirmed. Feedback will be given if necessary.

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集積回路工学(2)

[Course requirements]

Logic circuits, Computer engineering, Digital circuits, Embedded computer system

[Evaluation methods and policy]

The level of achievement toward the goal of this lecture will be examined by the results of reports. All reports are mandatory.

[Textbooks]

Hand-outs will be provided.

[References, etc.]

（Reference books）

Waste and Harris 『CMOS VLSI Design: A Circuits and Systems Perspective』 （Addison Wesley）ISBN: 978-0321547743

[Study outside of class (preparation and review)]

All reports are mandatory. Practices provided in the lecture should be solved after the lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36114 LJ71　U-ENG26 36114 LJ72		
Course title (and course title in English)	メカトロニクス入門 Introduction of Mechatronics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUNO FUMITOSHI Graduate School of Engineering Associate Professor,ENDO　TAKAHIRO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Wed.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Study of the basics of mechatronics, a multidisciplinary technology field comprised of mechanical and electronic aspects. The lectures will describe the history and concepts that make up the field of mechatronics and explain the individual technologies and applications of mechatronics.

The individual technologies comprising mechatronics include sensor/actuator/computer interfaces, actuator control methods, and their mechanisms. In addition, we will discuss robot manipulators as an application of mechatronics and explain concepts related to kinematics and dynamics.

[Course objectives]

The objective of this course is to cultivate an understanding of the basic concepts of mechatronics, a multidisciplinary field combining the principles of mechanical and electronic engineering. The course will pursue the following six objectives:

1. Understanding the history and development of the field of mechatronics.

2. Understanding the configuration of mechatronic systems.

3. Understanding and acquiring modes of thinking about mechatronic systems through the study of examples.

4. Study of the existing sensor and actuator systems and making selections.

5. Understanding computer control and the configuration of electronic machines that perform complex operations in different situations.

6. Understanding the basics of kinematics and dynamics of robotics as an application of mechatronic principles.

[Course schedule and contents]

Mechatronics, 3 sessions
These sessions will explain the definition and history of mechatronics, and provide an overview of the basic configurational characteristics utilized in the field of mechatronics.

Mechatronic components, 6 sessions
These sessions will describe the interfaces between sensors, actuators, and computer components that make up mechatronic systems.

Continue to メカトロニクス入門(2)↓↓↓

メカトロニクス入門(2)

Mechanisms and controls, 3 sessions
These sessions will discuss the types of mechanical motion and their mechanisms in addition to the basic aspects of actuator control used in robotic systems.

Basics of robotics, 2 sessions
These sessions will discuss robot manipulators and provide an overview of the kinematics and dynamics concepts.

Confirmation of learning achievement, 1 session
Achievement of learning will be evaluated through a written test.

Course feedback, 1 session

[Course requirements]

N/A

[Evaluation methods and policy]

Students will be evaluated primarily through tests, but points may also be earned from regular course assignments.

[Textbooks]

Not used

[References, etc.]

（Reference books）
Introduced during lectures

[Study outside of class (preparation and review)]

Review the content of the lecture through report assignments.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46115 LJ72		
Course title (and course title in English)	情報通信工学 Information and Communication Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,HARADA HIROSHI Graduate School of Informatics Professor,Oki Eiji Graduate School of Informatics Associate Professor,MURATA HIDEKAZU Graduate School of Informatics Associate Professor,YAMAMOTO KOUJI Graduate School of Informatics Associate Professor,SATO TAKEHIRO

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,3times,
,3times,
,3times,
,3times,
,2times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46116 LJ52　U-ENG26 46116 LJ57		
Course title (and course title in English)	電子物性工学 Solid State Physics and Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SHIRAISHI MASASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Tue.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Spintronics handles a wide variety of solid-state physics, and students are requested to understand various physics including quantum and statistical physics. We review a basis of solid-state physics, and then study mathematical physics such as group theory. The final goal is to master the cutting edge of modern solid-state physics for understanding frontier studies in spintronics.

[Course objectives]

As described in the course description

[Course schedule and contents]

Interaction between electron beam and atoms,3times,
,2times,
,2times,
k-space,3times,
physics of quasi-particle,1time,
magnetics and spintronics,3times,
,1time,

[Course requirements]

Brief review of solid-state physics until the 3rd year courses.

[Evaluation methods and policy]

Exam. and reports

[Textbooks]

None

[References, etc.]

（Reference books）

Continue to 電子物性工学(2)↓↓↓

電子物性工学(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

Course number	U-ENG26 36117 LJ72		
Course title (and course title in English)	真空電子工学 Vacuum Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,GOTOU YASUHITO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Vacuum Electronic Engineering deals with the devices that exhibit some functions by controlling the motion of the electrons (or charged particles) with electromagnetic fields. High power and high frequency vacuum tubes and ion implantation system that is used for impurity introduction to semiconductors are based on the theory of vacuum electronic engineering. This course explains fundamentals of the electron motion in vacuum and fundamentals on the control of electron beams are given; extraction of electrons from solid to vacuum, electron optics, and electron devices.

[Course objectives]

To understand the methods to extract electrons from solids, methods to control the electrons by electro-magnetic fields, and operational principle of the vacuum devices.

[Course schedule and contents]

[Introduction to Vacuum Electronic Engineering] Once
Application field of the vacuum electronic engineering will be shown.

[Extraction of electrons from solid to vacuum] 4 times
The mechanism of thermionic and field emission, which are mostly used to extract electrons in solids to vacuum, will be described in detail. The formula of the extractable current density for each mechanism will be presented, explaining the effects of image force and space charges.

[Motion of electrons in electromagnetic fields and its control] 5 times
The electron trajectories in electrostatic, magnetostatic, and orthogonal electromagnetic fields will be described. Lens effects of the electrostatic and magnetostatic fields will also be described, and concrete idea for application of these effects to practical devices will be presented.

[Electron beam devices] 4 times
Operational principle of the electron devices based on electron beams, namely vacuum tubes, will be described. Especially, principles of a velocity modulation tube will be presented, showing the advantage of vacuum electron devices for high power and high frequency application.

[Feedback] Once
Summarizing the above contents, degree of understanding will be evaluated.

[Course requirements]

Fundamental knowledge on electromagnetic theory, dynamics, electrons in solids, and electric and electronic circuits is necessary.

Continue to 真空電子工学(2)↓↓↓

真空電子工学(2)

[Evaluation methods and policy]

In principle, grading will be done with the result of the term-end examination.
Occasionally, some exercises may be given in the class, and submission of short reports may be taken into consideration to the evaluation.

[Textbooks]

Not used
No textbook will be used, but supplemental materials may be distributed in some cases.

[References, etc.]

（Reference books）

Tetsuro Tanaka 『Fundamentals of Material Science and Engineering』 （Asakura）ISBN:978-4-254-21003-3
Zyunzo Ishikawa 『Science and Technology of Charged Particle Beams』 （Corona）ISBN:978-4-339-00734-3

[Study outside of class (preparation and review)]

Necessary preparation will be shown at the end of each lecture.

[Extraction of electrons from solid to vacuum]
(In preparation) Review the band structure, density of states of electrons in solids, etc. that you leaned at "Fundamentals of Electron Physics and Devices" in the 2nd grade. Review the Poisson's equation, image charge method, etc. that you learned at "Electromagnetic Theory 1" in the 2nd grade.

[Motion of electrons in electromagnetic fields and its control]
(In preparation) Review the equations of motion of charged particles in electromagnetic fields that you are learning at "Electromagnetic Theory 2" in the 3rd grade.

[Electron beam devices]
(In preparation) Review the operating principle of semiconductor transistors and their equivalent circuits that you learned at "Electronic Circuits" in the 2nd grade.

（Other information (office hours, etc.)）

Bring your calculator, for the exercise that will be made in the class.

Suggested reading:
Steven Weinberg, "The discovery of subatomic particles", trans. by Saburo Honma (Chikuma) ISBN: 978-4-480-08967-5.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 26118 SJ72		
Course title (and course title in English)	電気電子回路演習 Exercise of Electric and Electronic Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,SHIMODA HIROSHI Graduate School of Engineering Associate Professor,HISAKADO TAKASHI Graduate School of Energy Science Associate Professor,ISHIZAWA AKIHIRO Institute for Liberal Arts and Sciences Program-Specific Senior Lecturer,KIMURA MASAYUKI Graduate School of Energy Science Assistant Professor,UEDA KIMI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Thu.3,4	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

Students will gain an understanding of phenomena that will serve as linkages between calculus and linear algebra, etc., learned during their first university year, and theories of electrical and electronic circuits. Students will also learn the basic concepts and ways of thinking employed in the field of electrical and electronic engineering. Also, in their personal environments, students will be able to learn about, via trial-and-error—freely and at their own initiative—numerical calculation, circuit simulation, and circuit testing. In their group, students will select a theme they find interesting, and via discussions using poster presentations, etc., students will deepen their mutual understanding and have the opportunity to be exposed to a variety of different opinions.

[Course objectives]

Via circuit theory, numerical calculation, circuit simulation, and circuit testing, students will boost their understanding of electrical and electronic circuits via linkages between a variety of viewpoints. The aim is for each student to establish a base on which to build their own subjective ideas and areas of interest within the broad field of electrical and electronic engineering.

[Course schedule and contents]

Overview explanation (1 class)
An overview of this seminar is presented, covering the topics of evaluations, goals, and progress methods. The seminar environment will be established during this first class.

Time-domain analysis (3 classes)
With respect to differential equations of circuits, via analysis using circuit simulators, phase plane analysis using linear algebra, and simple circuit experimentation, students will learn how to “decompose” phenomena into those of low-dimensional systems, so as to gain a better understanding.

Frequency-domain analysis (2 classes)
Students will learn about alternating-current (AC) circuit theory via linkages with time domain analysis.

2-port circuits (2 classes)
For circuits having input and output, students will learn about frequency characteristics from the viewpoint of pole-zero structure.

Continue to 電気電子回路演習(2)↓↓↓

電気電子回路演習(2)

Group discussion (1 class)
To deepen student understanding of course contents, investigation will be made regarding the contents of poster presentations.

Active circuits (3 classes)
Students will understand the concept of bias and deepen their understanding of circuit simulators and testing using amplification, switches, and feedback.

Presentations (3 classes)
Via their preparations for poster presentations, as well as their actual presentations, students will deepen their understanding of course content; this will also provide an opportunity to confirm the extent of learning of each student.

[Course requirements]

Prerequisites for this course are courses in fundamental theory of electrical circuits and in electrical and electronic circuits.

[Evaluation methods and policy]

Since this is an exercise subject, attending a class and working on an assignment is an essential requirement. Then, the achievement of the understanding of electrical and electronic circuits is evaluated by submitted reports. In addition, the attitude of the experimental room and active improvement measures are also evaluated.
Regarding the specific evaluation method, grades are calculated for each of active participation in the exercise, pre-assignment, development assignment, and submitted report by the deduction method from 100 points.

[Textbooks]

京都大学工学部電気系教室編：電気電子回路演習2016**年度版**

[References, etc.]

（Reference books）
奥村浩士 『エース電気回路理論入門』（朝倉書店）ISBN:4254227469
北野正雄 『電子回路の基礎』（レイメイ社）

[Study outside of class (preparation and review)]

As preparation for each seminar class, assigned exercises are to be performed and submitted to PandA. For review, students should perform work on advanced problems at home.

（Other information (office hours, etc.)）

For exercises, assigned machines (notebook PC, breadboard, etc.) shall be brought to the classroom. Prior to starting their seminar, students are to attend a guidance meeting for an explanation of the overall course. Students who borrow portable calculation devices to perform experiments should manage these devices

Continue to 電気電子回路演習(3)↓↓↓

appropriately. Office hours are in the Professor’s Lounge (S101) during second period on Thursdays. Students who do not understand pre-class assignments should definitely come during office hours and attend the seminar class only after their problems have been resolved.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 26119 EJ72

Course title (and course title in English)	電気電子工学基礎実験 Fundamental Practice of Electrical & Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,SATO TAKEHIRO Graduate School of Engineering Assistant Professor,TAKASHIMA HIDEAKI Institute of Advanced Energy Assistant Professor,OHSHIMA SHINSUKE Institute of Advanced Energy Associate Professor,KOBAYASHI SHINJI Institute of Advanced Energy Assistant Professor,SHINOKITA KEISUKE Graduate School of Engineering Associate Professor,SUGIYAMA KAZUHIKO Research Institute for Sustainable Humanosphere Professor,KOJIMA HIROTSUGU Graduate School of Informatics Associate Professor,YAMAMOTO KOUJI Graduate School of Engineering Assistant Professor,INOUE TAKUYA Graduate School of Engineering Assistant Professor,OSHIMA RYO Graduate School of Engineering Assistant Professor,YOSHIDA MASAHIRO Graduate School of Engineering Assistant Professor,SOGABE YUSUKE Research Institute for Sustainable Humanosphere Associate Professor,MITANI TOMOHIKO Graduate School of Energy Science Associate Professor,ISHII HIROTAKE Graduate School of Engineering Associate Professor,ASANO TAKASHI Research Institute for Sustainable Humanosphere Associate Professor,NISHIMURA KOJI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Thu.1,2,3,4	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

Via actual test measurements of the characteristics of electronic elements using basic measurement devices employed in electrical and electronic engineering fields, students will acquire the skills required for using these devices. Tests will also be performed to conduct initial step investigation of the mechanisms of electronic and electrical circuits and elements, and to deepen students' understanding of electrical and electronic engineering fields.

Continue to 電気電子工学基礎実験(2)↓↓↓

電気電子工学基礎実験(2)

[Course objectives]

The goals of this course are for students to acquire initial-stage testing techniques used within the electrical and electronic engineering fields, and to understand electrical and electronic circuits. The aim is to have students achieve these goals chiefly via the creation of electrical and electronic circuits, and via measurement tests of the characteristics of these circuits.

[Course schedule and contents]

Fundamentals of experiments in electrical and electronic engineering (lectures and experiments) (3 classes)
Discussion is made of aspects necessary in the performance of electronic/electrical engineering experiments, namely, the securing of a safe environment, the proper way to take experimental notes, how to draw graphs, and how to write related reports. Students will learn how to use an oscilloscope, which will give them a foundation in measurement technologies. Students will also have the opportunity to edit reports created by others, an activity designed to give them even keener insights in report writing.

Passive elements (experiments) (2 classes)
Frequency characteristics measurements (amplification, phase, etc.) are performed for circuits made from passive elements such as coils, capacitors, resistors, etc.

Active elements and amplifier circuits (experiments) (6 classes)
In these classes, characteristics measurements are performed for circuits made from diodes, bipolar transistors, and operational amplifiers. Through these experiments, students will gain an understanding of the operations of amplifier circuits, etc.

Logic circuits (experiments) (2 classes)
Students design and make combination circuits and sequential circuits to understand their operations.

Confirmation of extent of student learning (2 classes)
Students will be asked questions regarding experiment methods, contents/details, and report writing. This will help to deepen student understanding of experimentation details and will also enable confirmation of the extent of student learning in this course.

[Course requirements]

Prerequisites for this course are "Fundamentals of Circuit Theory" and "Electric and Electronic Circuits."

[Evaluation methods and policy]

From the contents of experiment reports, evaluations can be made with respect to the extent of student learning of experimental techniques, as well as regarding the level of their understanding of electrical and electronic circuits. Each student’s attitudes and engagements will also be evaluated in the experimental laboratory, and with respect to how proactive students are in striving for improvement. In other words, attendance at experiments is mandatory!

[Textbooks]

京都大学工学部電気系教室編 『電気電子工学基礎実験 2022年度版』
木下是雄 『理科系の作文技術』（中公新書）ISBN:4121006240

Continue to 電気電子工学基礎実験(3)↓↓↓

電気電子工学基礎実験(3)

[References, etc.]

（Reference books）
奥村浩士『エース電気回路理論入門』（朝倉書店）
奥村浩士『電気回路理論』（朝倉書店）
北野正雄『電子回路の基礎』（レイメイ社）

[Study outside of class (preparation and review)]

Students must be sure to attend the guidance meeting to be held before experiments begin, where they will receive an overall explanation, education on safety, etc.

（Other information (office hours, etc.)）

A portion of course contents may be omitted or changed, or new contents may be added.
On class days when experiments are performed, students must be sure to bring with them items designated beforehand, including report forms, etc.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 46200 LJ72		
Course title (and course title in English)	生体医療工学 Electrical and Electronic Engineering in Biomedical Applications	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,ISHII SHIN Graduate School of Engineering Professor,DOI SHINJI Graduate School of Energy Science Professor,SHIMODA HIROSHI Graduate School of Engineering Senior Lecturer,YOSUKE ITOH Graduate School of Engineering Professor,SAKAMOTO TAKUYA

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The course provides technologies based on electrical and electronic engineering in biomedical applications.

[Course objectives]

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

[Course schedule and contents]

Cell/biodynamics simulation,2-3times,electrophysiology, computer simulation of cell and biodynamics
Brain function measurement,2-3times,brain nerve system, magnetoencephalogram (MEG), functional magnetic resonance imaging (fMRI), and their applications
Visualization,2-3times,visualization techniques for numerical simulation, steering, optimization
Modeling and simulation of brain nerve system,2-3times,simulation of information processing in neuron, mathematical modeling and analysis of higher brain function, bioinformatics
Cognitive engineering,2-3times,features of human cognitive activities from the viewpoint of psychology, congnitive engineering and its applications
Biomedical systems,2-3times,systems engineering approach and biomedical application to life
Review,1time,The level of understanding on this lecture will be confirmed.

[Course requirements]

None

[Evaluation methods and policy]

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.

Continue to 生体医療工学(2)↓↓↓

生体医療工学(2)

[Textbooks]

Handouts are given at the class.

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Report assignment will be given for each topic.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 36201 EJ72		
Course title (and course title in English)	電気電子工学実験 Practice of Electrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,FUNATO MITSURU Graduate School of Engineering Associate Professor,ANDO YUUICHIROU Graduate School of Engineering Program-Specific Professor,NAKAMURA TAKETSUNE Research Institute for Sustainable Humanosphere Assistant Professor,UEDA YOSHIKATSU Graduate School of Informatics Associate Professor,MURATA HIDEKAZU Graduate School of Engineering Associate Professor,OKAMOTO RYOU Graduate School of Engineering Associate Professor,KOBAYASHI KEI Academic Center for Computing and Media Studies Associate Professor,KONDO KAZUAKI Graduate School of Engineering Senior Lecturer,HOSOE YOUHEI Graduate School of Engineering Assistant Professor,SHIGEMATSU EI Graduate School of Engineering Associate Professor,ETO YUJIRO Graduate School of Engineering Assistant Professor,UEDA HIROYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Fri.1,2,3,4	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

In this course, students acquire fundamental knowledge and practical skills, via basic experiments and discussions, regarding electrical machines, semiconductor properties and devices, electromagnetic waves, computers, and communications.

[Course objectives]

The goals of this class are for students to gain an understanding of fundamental items, including the principles and characteristics of various electrical equipment, semiconductor characteristics and device characteristics, electromagnetic wave propagation and interference, computer hardware and software, characteristics of communication methods, etc.

[Course schedule and contents]

Overview of practical of electrical and electronic engineering (1 class)
Explanation is made of fundamental items and points of special precaution for experiments in electrical and electronic engineering, and students are educated in safety issues related to experiments.

Electrical equipment and devices (2 classes)
Students perform measurement of the basic characteristics of transformers, induction machines, direct current

Continue to 電気電子工学実験(2)↓↓↓

(DC) machines, and synchronous machines. Students will gain an understanding of the characteristics of generators and electric motors, and they will also study three-phase alternating current.

Semiconductor characteristics and devices (4 classes)
Students will measure band gap, light absorption, and other characteristics of semiconductors; measurement is also made of the characteristics of diodes and field-effect transistors, basic devices that use semiconductors. In this way, students gain an understanding of their operations and of the physics that serve as the background for such devices.

Fundamentals of electromagnetic waves (2 classes)
Experiments are performed on the propagation of electromagnetic waves in dual conductor lines and in free space, enabling students to gain knowledge of the characteristics and measurement methods of electromagnetic waves.

Microcomputers (2 classes)
Using microcomputers, students will gain an understanding the structure (composition) and functions of computers, as well as an understanding of the relationships between hardware and software within a computing system.

Communications fundamentals (2 classes)
Measurement is made of time signals and frequency spectra, the basic modulation method used in communications. Students will understand the characteristics of various modulation methods, as well as the effects of sampling.

Confirmation of extent of student learning (2 classes)
Discussion is made regarding experiment methods and contents, enabling students to deepen their understanding of experiment details and giving them a greater ability to explain the like. Additionally, confirmation is made of the extent of student learning.

[Course requirements]

Prerequisites for this course are student acquisition of fundamental knowledge of electrical circuits, electronic circuits, and electromagnetism. Students must also have completed a course in fundamental practice of electrical & electronic engineering.

[Evaluation methods and policy]

From the contents of experiment reports, evaluations can be made with respect to the extent of student learning of experimental techniques, as well as regarding the level of their understanding of electrical and electronic circuits. Evaluation will also be made of each student’s attitudes and engagement in the experimental laboratory. Therefore, attendance at experiments is mandatory!

[Textbooks]

京都大学工学部電気系教室編：電気電子工学実験2019年版

Continue to 電気電子工学実験(3)↓↓↓

電気電子工学実験(3)

[References, etc.]

（Reference books）

京都大学工学部電気系教室編：電気電子工学基礎実験

[Study outside of class (preparation and review)]

Students must read and study the textbook before each experiment.

（Other information (office hours, etc.)）

Students are required to attend the 1st class (Overview of Practice of Electrical and Electronic Engineering) to be held before experiments begin. At this class, overall explanations are made, as well as education about safety, etc.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36202 PJ72

Course title (and course title in English)	電気電子工学実習 Advanced Practice of Electrical and Electronic Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,YOSUKE ITOH Graduate School of Engineering Associate Professor,KAKEYA ITSUHIRO Graduate School of Engineering Assistant Professor,KANEKO MITSUAKI Graduate School of Engineering Associate Professor,GOTOU YASUHITO Graduate School of Engineering Assistant Professor,MOCHIYAMA SHIU Graduate School of Engineering Assistant Professor,ISHI RYOTA Graduate School of Informatics Assistant Professor,HIGASHI HIROSHI Graduate School of Engineering Professor,SAKAMOTO TAKUYA Graduate School of Engineering Assistant Professor,HIRUMA SHINGO Graduate School of Engineering Senior Lecturer,MIFUNE TAKESHI Graduate School of Informatics Program-Specific Associate Professor,MIZUTANI KEIICHI Graduate School of Informatics Program-Specific Assistant Professor,NAKAE KEN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Fri.1,2,3,4	Class style	Practical training	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Techniques and safety for experiments,1time,
Power electronics,4times,
DC servo mortors,4times,
Semiconductor devices ,4times,
Materials for electronics,4times,
Communication systems,4times,
Logic circuits,4times,
Feedback,2times,

Continue to 電気電子工学実習(2)↓↓↓

電気電子工学実習(2)

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36203 LJ72		
Course title (and course title in English)	電力システム工学 Power System Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HIKIHARA TAKASHI Graduate School of Energy Science Professor,SHIRAI YASUYUKI 大阪府立大学大学院工学研究科　准教授 SUSUKI YOSHIHIKO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Mon.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Electric power system is a large-scale engineered system to supply electrical energy from generation facilities, through substations, transmission and distribution networks, to loads. This course provides an introduction to power systems engineering for students of electrical and electronic engineering. Topics include the system structure, interconnected systems, dc and ac transmissions, stability, frequency and voltage control, economic aspects of power system operation, and fault analysis.

[Course objectives]

The goal of this course is to understand fundamentals of power systems engineering, including their operation, analysis, and control.

[Course schedule and contents]

Intriductuon,1time,Features of power system and the purpose of network operation are introduced.
System structure and Per Unit (PU) system,1-2times,Dc and ac power transmission are explained from the view point of system structure. Per unit method is explained.
Frequency control,2-3times,Controlling methods for keeping synchronicity at 60/50 Hz are explained.
Voltage control,2times,Voltage levels of power system is classified. The control method for keeping the voltage constant is explained.
Stability,3times,System stability is explained from the view point of engineering and applied mathematics.
Fault analysis,2times,Fault analysis of power system is introduced.
System Operation,1-2times,Operating method of power system with various power sources.
Summary, **1** times,

[Course requirements]

Circuit Theory (60630, 60030, 60220); Electric Machinery Fundamentals (61050); Electric Power Engineering 1 (61070)

[Evaluation methods and policy]

Final examination and homework.

Continue to 電力システム工学(2)↓↓↓

電力システム工学(2)

[Textbooks]

Handouts.

[References, etc.]

（Reference books）

Y. Ohsawa, Power Systems Engineering (Ohm-Sha) (in Japanese) isbn{}{4274132307} ; Y. Sekine, Power system engineering (Denki-Shoin) (in Japanese) ibid{}{TW86022983}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG26 46204 LJ72		
Course title (and course title in English)	応用電力工学 Applied Electric Power Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUO TETSUJI Graduate School of Energy Science Associate Professor,TAKAI SHIGEOMI Part-time Lecturer,FUJITA HIROFUMI Part-time Lecturer,MATSUMURA YASUTAKA Part-time Lecturer,GOMI SHUNICHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2022/First semester
Days and periods	Mon.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course provides an introduction to power generation technologies for students of electrical and electronic engineering. This is the first course in power and energy engineering in the School of Electrical and Electronic Engineering. Topics include fundamentals of hydraulic, thermal, and nuclear power plants, fundamentals and current trends of renewable energy resources, and batteries.

[Course objectives]

The goal of this course is to understand fundamentals of power generation technologies.

[Course schedule and contents]

"1. Introduction (1 class)

Provide an overview of present conditions, future trends, etc. with respect to energy supply, including electric power, and describe the outline of the course and its goals.

2. Thermal power generation (3 classes)

After reviewing the basics of thermodynamics, explain the types of thermal power stations, including combined cycle power generation, as well as the components and operating principles of thermal power generation plants.

3. Hydroelectric power generation (2 classes)

After discussing the basics of hydraulics, explain the structures and characteristics of public works such as the dams, waterways, surge tanks, pipelines, etc. that make up hydroelectric power stations, as well as hydraulic turbines and hydraulic turbine generators.

4. Nuclear power generation (3 classes)

After reviewing the basics of atomic physics, explain basic information on nuclear fission, which is the core of nuclear power generation, and the operation of nuclear reactors, as well as the types of nuclear power stations and nuclear fuel.

Continue to 応用電力工学(2)↓↓↓

応用電力工学(2)

5. Electrical generation methods using renewable energy (2 classes)

As well as explaining electrical generation and environmental problems, explain methods of generating electricity that use renewable energy, i.e., alternative energy sources such as solar power and wind power.

5. Electrical generation by battery (2 classes)

Explain the principles of the conversion of chemical energy to electrical energy, fuel cells, rechargeable lithium batteries, and so on.

6. Summary (feedback class)

As well as summarizing the electrical generation methods we have studied, confirm the degree of learning attainment."

[Course requirements]

Basic circuit theory; Fundamental physics and chemistry

[Evaluation methods and policy]

Final examination or homeworks in the term.

[Textbooks]

Handouts.

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Students are advised to review class material using documents, etc.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

Continue to 応用電力工学(3)↓↓↓

応用電力工学(3)

(3) Details of practical classes delivered based on instructors’ practical work experience

未更新

Course number	U-ENG26 36205 LJ72		
Course title (and course title in English)	機械学習 Machine Learning	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,ISHII SHIN Graduate School of Informatics Professor,NISHINO KO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Thu.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Teaching sessions aim to help students learn the basics and applications of machine learning. Students are taught theoretical foundations and applications of statistical machine learning methods (in particular, supervised learning, unsupervised learning, and reinforcement learning), which are inductive approaches to solving complex problems.

[Course objectives]

To acquire knowledge about the basics of machine learning and to deepen one's understanding to a practical level by writing reports that involve programming.

[Course schedule and contents]

・ Introduction to statistical machine learning (1 session): Explanations are given on the basic concepts of supervised and unsupervised learning with regards to machine learning based on statistical probability theory. (Professor: Ko Nishino)

・ Supervised learning (6 sessions): In relation to supervised learning, students are taught about linear regression involving the least squares method (1 session), and are given an explanation about linear discrimination involving support vector machines (1 session). Following this, students are taught to solve non-linear optimization problems with gradient methods using perceptrons as a subject (1 session), as well as multi-layer perceptrons and the backpropagation learning method used for them (1 session), deep networks centered on convolutional networks (1 session), and progression towards time series represented by LSTM (1 session). (Professor: Ko Nishino)

・ Unsupervised learning and statistical inference (4 sessions): In terms of unsupervised learning, students are taught basic ideas based on the statistical inference performed via probabilistic models (1 session), graphical models and the inference of the maximum likelihood (1 session), Bayesian inference (1 session), and the applications of image processing, etc (1 session). (Professor: Shin Ishii)

・ Reinforcement learning and exploration (3 sessions): With regards to reinforcement learning, which is an autonomous form of control learning based on rewards, students are taught about derivation from dynamic programming (1 session), formulation via probability approximation methods (1 session), and deep reinforcement learning, which has been applied more in recent years (1 session). If there is time, students are also taught the bandit problem (exploration problem). (Professor: Shin Ishii)

・ Application of machine learning in artificial intelligence (1 session): Students are informed about the latest situation regarding the application of machine learning in artificial intelligence. (Professors: Ko Nishino, Shin Ishii)

Continue to 機械学習(2)↓↓↓

機械学習(2)

[Course requirements]

Students are required to have knowledge of computer software (60370).

[Evaluation methods and policy]

[Evaluation method]
Marks from exercises in teaching sessions and reports involving programming (80%); evaluation of performance in teaching sessions (20%)
Performance in teaching sessions is evaluated based on participation and remarks made in teaching sessions.
[Evaluation policy]
Achievement targets are evaluated according to the grade evaluation policy of the Faculty of Engineering.

[Textbooks]

Others; printouts are used.

[References, etc.]

（Reference books）

Others; Bishop, C., (translated by Motoda, H., and others), Pataan ninshiki to kikai gakushuu jouge - beizu riron ni yoru toukei-teki yosoku, Springer Japan (2007)

[Study outside of class (preparation and review)]

Students must work on reports and assignments that involve programming.

（Other information (office hours, etc.)）

Separate feedback time is provided after all lectures.
* For details on office hours, please check KULASIS.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category
A course with practical content delivered by instructors with practical work experience

(2) Details of instructors’ practical work experience related to the course

(3) Details of practical classes delivered based on instructors’ practical work experience

Course number	U-ENG26 46997 GB72		
Course title (and course title in English)	特別研究 Graduation Thesis	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF

Target year	4th year students or above	Number of credits	6	Year/semesters	2022/Intensive, year-round
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

電気電子工学に関連するテーマについて研究を進め、学士論文を作成する。

[Course objectives]

研究テーマに関する議論・討論・演習を通じ、研究課題抽出・問題解決能力などの研究能力を得るとともに、学術的・技術的内容を明確に説明するコミュニケーション能力を高める。

[Course schedule and contents]

指導教員と協議して決める。
例えば、週２コマ程度のゼミと、週１回以上の個別の課題検討など。

[Course requirements]

特別研究を開始するためには、その年度の初めに電気電子工学科特別研究細則（入学年度ごとに規定）の要件を満たしていなければならない。

[Evaluation methods and policy]

研究課題に対する理解度・演習実施状況、学士論文に対する口頭試問に基づき、総合的に評価する。
なお、学士論文の作成にあたっては学士論文作成規定に従うこと。

[Textbooks]

Not used

[References, etc.]

（Reference books）
学士論文作成規定および手引を配付する。

[Study outside of class (preparation and review)]

研究テーマに応じて自主的に学習することが求められる。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 29030 LJ10		
Course title (and course title in English)	グラフ理論（電気電子） Graph Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,KAWAHARA JUN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2022/Second semester
Days and periods	Thu.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

We learn basic theories of graphs and their applications, and fundamental algorithms for solving graph problems.

[Course objectives]

The goal of this course is to learn basic theories of graphs and their applications, and fundamental algorithms for solving graph problems.

[Course schedule and contents]

1. Foundations of Graphs and (4 timeslots)
I explain definition of graphs and basic properties of graphs. I also briefly review the basics of algorithms and their complexity.

2. Minimum spanning trees (1 timeslot)
Kruskal's algorithm, Prim's algorithm, Steiner tree problem.

3. Shortest path problems (1 timeslot)
Dijkstra's algorithm.

4. Eurer circuits and Hamiltonian cycles (2 timeslots)
Eurer circuits, Hamiltonian cycles, Dirac's theorem. Ore's theorem.

5. Graph coloring (2 timeslots)
Vertex coloring and edge coloring. Brooks's theorem, Vizing's theorem, Konig's theorem. Coloring maps.

6. Maximum flow problems (2 timeslots)
Ford-Fulkerson's algorithm.

7. Matching (2 timeslots)
Matchings, in particular, bipartite matchings. Hall's theorem, Hungarian method.

8. Exam (1 timeslot)

Continue to グラフ理論（電気電子）(2)↓↓↓

グラフ理論（電気電子）(2)

[Course requirements]

Basics of algorithms, data structures, and set theory.

[Evaluation methods and policy]

Mainly evaluated by the final exam. In some cases, exercises or the number of attendance to the class may be considered.

[Textbooks]

宮崎修一『グラフ理論入門～基本とアルゴリズム～』（森北出版株式会社）ISBN:978-4-627-85281-5（Written in Japanese）

[References, etc.]

（Reference books）

I may show some recommended books in class.

[Study outside of class (preparation and review)]

Reading the textbook is effective for study. Due to time constraints, I do not give complete description of the proofs in class. I strongly recommend do it by yourself after the class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.