Course number	U-ENG29 22050 LJ10　U-ENG29 22050 LJ55		
Course title (and course title in English)	工業数学A 1 Applied Mathematics A1	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,SHIBAYAMA MITSURU

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Thu.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Complex analysis, traditionally known as the theory of functions of a complex variable, is the branch of mathematical analysis that investigates functions of complex numbers. Students will study the foundation and apply it to compute some integral.

[Course objectives]

To understand properties of complex functions with a skill for evaluation of integrals appearing in applied mathematics and physics.

[Course schedule and contents]

1. Complex function
2. Holomorphic functions
3. Elementary functions
4. Integrals in the complex plane
5. Cauchy's integral theorem
6. Power series
7. Taylor series
8. Isolated singularities
9. Laurent series
10. Multivalued functions
11. Analytic continuation
12. Residue
13. Integrals including trigonometric functions
14. Application to improper integral
15. Point at infinity and Riemann sphere

[Course requirements]

Calculus, Linear algebra

Continue to 工業数学A 1 (2)↓↓↓

工業数学Ａ１(2)

[Evaluation methods and policy]

Evaluation depends mainly on marks of examination, but marks of exercises are taken into account when needed.

[Textbooks]

Not used

[References, etc.]

（Reference books）

Lars V. Ahlfors 『Complex Analysis』 （McGraw-Hill Education）ISBN:978-0070006577

（Related URLs）

(KULASIS)

[Study outside of class (preparation and review)]

Students need to solve exercises.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 32060 LJ55　U-ENG29 32060 LJ10　U-ENG29 32060 LJ54		
Course title (and course title in English)	工業数学Ａ２ Applied Mathematics A2	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,FUJIWARA HIROSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

計算機による数値シミュレーションは現代の科学・技術において基礎的かつ普遍的な手法のひとつであり，それら数値シミュレーション手法の信頼性は現代では数学理論に則って論じられる．本講義では代表的な手法を対象に信頼性を述べるとともに，そこでもちいられる数学的手法の枠組みも紹介する．

[Course objectives]

計算機による数値シミュレーション手法のアルゴリズムだけでなく，計算手法の信頼性を，線形代数・微積分や関数解析等の数学的枠組みに則って理解する．

[Course schedule and contents]

非線形方程式の近似解法(3回程度)，Newton 法等を紹介し，収束性や基本的な性質を述べる．
関数近似と数値積分(3回程度)，多項式による近似，台形則やGauss型の数値積分則について，計算手法と誤差評価等を述べる．
Banach空間とHilbert空間の基本的な性質(4回程度) 偏微分方程式の数値解法等の信頼性を調べる代表的な数学的枠組みを紹介する．
偏微分方程式の数値解法の基礎理論(4回程度)，差分法等を対象に，数値計算手法の信頼性を述べる．

数値シミュレーションの先端的話題 (1回程度)，講義で紹介した手法等がどのように発展し応用されるか，紹介する．
概ねこの順序で進めるが，履修生の理解に応じて順序や講義回数を調整しながら進める．

[Course requirements]

１回生で学習する程度の微分積分，線形代数．

[Evaluation methods and policy]

講義中に課すレポート（20%) と期末試験 (80%)

Continue to 工業数学Ａ２(2)↓↓↓

工業数学Ａ２(2)

[Textbooks]

Not used

[References, etc.]

（Reference books）

一松信『数値解析』（朝倉書店，1982）ISBN:978-4-254-11443-0
Rainer Kress『Numerical Analysis』（Springer, 1998）ISBN:978-1-4612-6833-8
黒田成俊『関数解析』（共立出版. 1980）ISBN:978-4-320-01106-9

（Related URLs）

(——)

[Study outside of class (preparation and review)]

プログラミングは必須ではないが，講義で紹介する数値シミュレーション法を各自でプログラムを作成して実行することで，講義内容の理解が促進される．

（Other information (office hours, etc.)）

特に設定しないが，質問などは講義終了時など，随時受け付ける．

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 32070 LJ10　U-ENG29 32070 LJ55		
Course title (and course title in English)	工業数学Ａ３ Appleid Mathematics A3	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,MASE TAKAFUMI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Mon.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Fourier analysis originated in Fourier's work on thermal conduction and now becomes very important not only in mathematics but also in engineering, including applications in measurement technology. This course provides its theories and applications along with the Laplace transforms closely related to it.

[Course objectives]

To understand the fundamental theories of Fourier analysis and Laplace transforms and develop an ability to apply them to concrete problems.

[Course schedule and contents]

Fourier series expansions, 3-4 times:
The definition of Fourier series expansions for periodic functions are given and their fundamental results such as computation of Fourier coefficients and convergence of Fourier series are discussed.
Properties and applications of Fourier series, 3-4 times:
Several properties of Fourier series and their applications to differential and difference equations and signal processing are discussed.
One-dimensional Fourier transform, 4-5 times:
The definition of one-dimensional Fourier transforms is given, and their fundamental properties such as the inversion formula and applications to partial differential equations are discussed.
Laplace transforms, 2-3times:
Fundamental properties of Laplace transforms and their applications are discussed.
Summary and learning achievement evaluation, 1 time:
A summary and supplements of this course are given and the learning achievement of students is evaluated.

[Course requirements]

Calculus, Linear Algebra and Differential Equations

[Evaluation methods and policy]

Evaluation depends mainly on marks of mid-term examinations (20%) and final one (80%).

Continue to 工業数学Ａ３(2)↓↓↓

工業数学Ａ３(2)

[Textbooks]

S. Nakamura 『Fourier Analysis』 （Asakura shoten, 2003）ISBN:9784254115741

[References, etc.]

（Reference books）

H.Fukawa 『Mathematics of control and vibration』 （Korona-sha）

[Study outside of class (preparation and review)]

Prepare and review the lectures and solving the problems given on KULASIS or LMS to understand the contents of the textbook and lectures.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

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,ISHIDA TAIICHIROU Graduate School of Engineering Professor,SENDA KEI Graduate School of Engineering Professor,KAWASE MOTOAKI Graduate School of Informatics Professor,KAWAHARA TATSUYA Graduate School of Letters Professor,ISEDA TETSUJI Part-time Lecturer,TATEBA TAKAFUMI Graduate School of Energy Science Professor,FUJIMOTO HITOSHI Graduate School of Engineering Professor,FUJIHARA TETSUAKI Graduate School of Engineering Professor,SUZUKI MOTOFUMI Graduate School of Management Professor,ICHIKAWA YUTAKA Office of Institutional Advancement and Communications NAKAGAWA　MASAYUKI Graduate School of Engineering Professor,URAYAMA KENJI Graduate School of Engineering Professor,KANETA TAKASHI Graduate School of Energy Science Professor,KAWANABE HIROSHI Graduate School of Engineering Senior Lecturer,HAYASHI KAZUKI

Target year	4th year students or above	Number of credits	2	Year/semesters	2026/First semester
Days and periods	Thu.3	Class style	Lecture (Media-based course)	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]

Lectures on ethics in various fields of engineering will be given by faculty members of the Graduate School of Engineering or other graduate schools. (Details will be provided after they are determined.)
This course is a media course in which all lectures will be given online via Zoom.

Continue to 工学倫理(2)↓↓↓

工学倫理(2)

Lectures on ethics in various fields of engineering will be given by faculty members of the Graduate School of Engineering or other graduate schools. (Details will be provided after they are determined.)

[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

[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

[Essential courses]

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 Professor,TOMISHIMA YOSHIAKI Graduate School of Engineering Professor,MURAKAMI SADAYOSHI Graduate School of Global Environmental Studies Professor,Fujiwara Taku Graduate School of Informatics Professor,KASHIMA KENJI Graduate School of Engineering Professor,YOSHII KAZUYOSHI Office of Institutional Advancement and Communications Project Professor,KITANI TETSUO Graduate School of Engineering Professor,SANO NORIAKI Graduate School of Engineering Senior Lecturer,ISHITSUKA KAZUYA

Target year	1st year students or above	Number of credits	1	Year/semesters	2026/Intensive, First semester

Days and periods	Intensive	Class style	Lecture (Face-to-face course)	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.

[Essential courses]

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 Graduate School of Engineering Senior Lecturer,KOWHAKUL, Wasana

Target year	3rd year students or above	Number of credits	1	Year/semesters	2026/Intensive, year-round

Days and periods	Intensive	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese and English

[Overview and purpose of the course]

The internships and related training programs conducted overseas and offered through the Faculty of Engineering and its undergraduate departments at Kyoto University (lasting less than three months) are eligible. Programs conducted domestically are also included, provided they are expected to offer learning outcomes comparable to overseas internships. The aim is to cultivate independence, initiative, international awareness, and language skills by placing students in diverse environments, thereby supporting their career development after graduation.

[Course objectives]

The purpose is to enhance the expansion of international perspectives, the acquisition of international sensibilities, the improvement of foreign language proficiency (communication skills), and the enhancement of cultural receptiveness (cross-cultural adaptability) by experiencing internships in diverse environments such as overseas universities and companies.

[Course schedule and contents]

[Submission of the internship plan (1 time)]
Complete and submit the form ‘International Internship Plan’ at least one month before the internship takes place and undergo a preliminary review.

[Overseas internship (1 time)]
Participate in an internship abroad.

[Results debriefing (1 time)]
Internship participants report on the results of their internship and discuss their findings.

[Course requirements]

Have sufficient language skills in the language(s) spoken at the internship site.
* Must have purchased the prescribed overseas travel insurance before traveling to the internship site.
* Have submitted an overseas travel registration form in advance.

[Evaluation methods and policy]

After registering for the course, one month prior to participating in the internship, students must fill out the “International Internship Plan” on the designated form and submit it to the Undergraduate Student Section of Educational Affairs Division for prior review by the faculty members of the ER center.

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)

After completion of the internship, students will be awarded credits (100%) based on the submission of an internship report and the content of the presentation at the debriefing session.
It is also advisable to submit a certificate of completion from the institution hosting the internship.
The decision to grant credits for graduation will be made by each undergraduate school. If the credits are not approved as credits required for graduation, the ER center will make the decision. In this case, the credits will be treated as excess credits.
Whether the internship is approved as credit for “１” (1 credit) or “２” (2 credits) of the International Internship Program of the Faculty of Engineering is determined based on the duration of the internship and the content of the practical training during the internship period, but in the case of “２,” overseas travel is required.

[Textbooks]

Not used

[References, etc.]

（Reference books）
None

[Study outside of class (preparation and review)]

Please consult with your supervisor about your proposal before submitting it to us.
Further instructions will be given as appropriate.

（Other information (office hours, etc.)）

Before participating in an internship program, please inquire with the administrative office of your undergraduate school to determine whether or not the internship you wish to participate in will be approved as a credit toward completion of the program. For other information, please contact the ER center.

ER center
Tel: 075-383-2048
Mail: 090aglobal※mail2.adm.kyoto-u.ac.jp (Replace ※ with @)

*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

Continue to 工学部国際インターンシップ１(3)↓↓↓

工学部国際インターンシップ１(3)

[Essential courses]

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,ISHITSUKA KAZUYA

Target year	2nd year students or above	Number of credits	1	Year/semesters	2026/Intensive, year-round

Days and periods	Intensive	Class style	Seminar (Face-to-face course)	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

[References, etc.]

（Reference books）

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)

（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

[Essential courses]

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 Graduate School of Engineering Senior Lecturer,KOWHAKUL, Wasana

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Intensive, year-round

Days and periods	Intensive	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese and English

[Overview and purpose of the course]

The internships and related training programs conducted overseas and offered through the Faculty of Engineering and its undergraduate departments at Kyoto University (typically about three months or longer, as a general guideline) are included. The aim is to cultivate independence, initiative, international awareness, and language skills by placing students in diverse environments, thereby supporting their career development after graduation.

[Course objectives]

The purpose is to enhance the expansion of international perspectives, the acquisition of international sensibilities, the improvement of foreign language proficiency (communication skills), and the enhancement of cultural receptiveness (cross-cultural adaptability) by experiencing internships in diverse environments such as overseas universities and companies.

[Course schedule and contents]

[Submission of the internship plan (1 time)]
Complete and submit the form ‘International Internship Plan’ at least one month before the internship takes place and undergo a preliminary review.

[Overseas internship (1 time)]
Participate in an internship abroad.

[Results debriefing (1 time)]
Internship participants report on the results of their internship and discuss their findings.

[Course requirements]

Have sufficient language skills in the language(s) spoken at the internship site.
* Must have purchased the prescribed overseas travel insurance before traveling to the internship site.
* Have submitted an overseas travel registration form in advance.

[Evaluation methods and policy]

After registering for the course, one month prior to participating in the internship, students must fill out the “International Internship Plan” on the designated form and submit it to the Undergraduate Student Section of Educational Affairs Division for prior review by the faculty members of the ER center.

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)

After completion of the internship, students will be awarded credits (100%) based on the submission of an internship report and the content of the presentation at the debriefing session.
It is also advisable to submit a certificate of completion from the institution hosting the internship.
The decision to grant credits for graduation will be made by each undergraduate school. If the credits are not approved as credits required for graduation, the ER center will make the decision. In this case, the credits will be treated as excess credits.
Whether the internship is approved as credit for “１” (1 credit) or “２” (2 credits) of the International Internship Program of the Faculty of Engineering is determined based on the duration of the internship and the content of the practical training during the internship period, but in the case of “２,” overseas travel is required.

[Textbooks]

Not used

[References, etc.]

（Reference books）

None

[Study outside of class (preparation and review)]

Please consult with your supervisor about your proposal before submitting it to us.
Further instructions will be given as appropriate.

（Other information (office hours, etc.)）

Before participating in an internship program, please inquire with the administrative office of your undergraduate school to determine whether or not the internship you wish to participate in will be approved as a credit toward completion of the program. For other information, please contact the ER center.

ER center
Tel: 075-383-2048
Mail: 090aglobal※mail2.adm.kyoto-u.ac.jp (Replace ※ with @)

*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

Continue to 工学部国際インターンシップ２(3)↓↓↓

工学部国際インターンシップ２(3)

[Essential courses]

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		
Target year	2nd year students or above	Number of credits	1	Year/semesters	2026/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

The capabilities that society expects from Kyoto University students primarily include "deep knowledge in their respective fields of specialization" and the "ability to identify issues on their own and present a path to resolution." In this course, you will develop the latter capability, which is difficult to acquire through regular lectures and university life, by creating new business plans through group work. While individual activities are allowed, group activities are encouraged.

[Features of this Course]
1. Distinguished Instructors: Under the mentoring of renowned innovators active in the business world, students will engage in setting challenges and planning solutions.
2. Activity Budget: A budget will be provided for market research, prototype production, and software development necessary for developing project proposals.
3. Presentation Opportunities: Outstanding proposals may be displayed at the Katsura Library, among other opportunities for commercialization.

[Mentors]
- Mitsuaki Oshima, Special Appointment Professor (Honorary Technical Supervisor at Panasonic HD, Director of ESL Research Institute): A leading Japanese innovator, known for inventions like image stabilization for cameras and 5G communication technologies. Recipient of the Purple Ribbon Medal and the Order of the Rising Sun, Gold Rays with Rosette.
https://hillslife.jp/learning/2018/05/06/new-perspective6/
- Seiichi Nishimoto, Honorary Professor (Chairman of the Kyoto Advanced Technology Research Institute): Supports the development of science and technology in the Kyoto area and the growth of ventures and SMEs.
https://www.astem.or.jp/about/researcher/nishimoto
- Kentaro Kaneko, Professor (Ritsumeikan University, Research Organization of Science and Technology; Director of RItsumeikan Semiconductor Application research center): Co-founder of FLOSFIA and Patentix, continuously innovating new semiconductor materials.
https://kaneko-lab.ritsumei.ac.jp/
https://www.ritsumei.ac.jp/research/center/risa/
- Teppei Tsushima, Open Innovation Dept., IP Div., Sony Corporation: Founder of Sony's smartwatch business, wena.
https://www.sony.com/ja/SonyInfo/DiscoverSony/articles/202203/wena/
- Hideki Aoyama, Special Appointment Lecturer, Panasonic HD: Developer of the visible light communication technology LinkRay(TM) and vice-chairman for the international standardization of the IEEE802.15.7 communication standard.
https://hidekia.github.io/

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)↓↓↓

- Tsutomu Mukai, Senior Manager, Panasonic HD: Promotes open innovation with venture companies in Israel.

Professor Mitsuaki Oshima is one of Japan's "Top 10 Representative Inventors," known for inventing and developing fundamental patents in technologies such as camera image stabilization in iPhones and high-speed and ultra-low latency communication for 5G mobile phones. Additionally, he invented multi-disciplinary technologies like anti-piracy measures for Nintendo Wii software, digital TV broadcasting standards in Japan, the US, and Europe, and IoT home appliances. He is famous as a serial innovator. Professor Oshima will introduce how groundbreaking inventions that change society originate.

In addition to the mentors, you can learn about the support system for startups and patent strategies from the invited lecturers. For those considering starting a startup, there is information that can be immediately utilized, and for others, there are valuable lessons that will be beneficial when entering society.

More information can be found on the following page (in Japanese):
https://www.erc.t.kyoto-u.ac.jp/ugrad

[Notes]
This seminar is intended for students in their second year of the Engineering Department or higher. The seminar is worth one credit, but whether it is recognized as a required credit for graduation depends on the undergraduate school. Please confirm with your undergraduate school office. Also, a camp is planned for December 5th and 6th, so it is necessary to be enrolled in the Personal Accident Insurance for Students Pursuing Education and Research(“Gakkensai”). Participation in the camp is recommended.

[Course objectives]

Through group work, you can acquire the ability to plan and propose solutions, starting from identifying and setting challenges to envisioning the creation of social value.

[Course schedule and contents]

The course will be conducted in person.
- [Orientation] (1 session): The overview and schedule of the course will be explained.
- [Lectures] (4 sessions): Special lectures by experts will be conducted.
- [Team Building (1 session): An exercise in team building, essential for group work, will be carried out.
- [Group Work] (7 sessions): Students will engage in setting challenges, problem identification, data collection, and group work. Through intensive group work discussions, they will plan and propose solutions to the identified issues, create a draft report, and conduct 2-3 presentations. Holding mini-lectures by special instructors will also be planned.
- [Camp] (1 session): An intensive session dedicated to project work in an environment exclusive to participants and mentors through overnight training camp.
- [Preliminary Review Session] (1 session): A class to practice presentations in preparation for the final presentation event.
- [Final Presentation Event] (1 session): The final presentations will take place, followed by submission of presentation materials.

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) (3)↓↓↓

[Course requirements]

If the number of students enrolling in the course is large, the maximum number of students may be determined.

[Evaluation methods and policy]

[Evaluation Method]
Grades will be based on regular participation (20%) and the presentation and submission of presentation materials at the final presentation event held during the last lecture session (80%). Regular participation evaluation will focus on the student's active participation in the lectures.

[Evaluation Policy]
We will comprehensively evaluate the ability to identify and set challenges through group discussions, as well as the ability to propose solutions towards achieving goals. Students are required to develop individual or group business plans through the challenges and group work, and to present them at the final presentation event.

Attendance in lectures per se is not a criterion for grade evaluation; however, as the course involves group work, regular attendance is strongly recommended.

[Textbooks]

We will let you know if necessary.

[References, etc.]

（Reference books）
III. Oreilly, Charles A. 『Lead and Disrupt: How to Solve the Innovator's Dilemma』（Stanford Business Books, 2021）ISBN:978-1503629523
We will let you know if necessary.

[Study outside of class (preparation and review)]

Please prepare and develop your own ideas in advance that you would like to work on throughout the course.

（Other information (office hours, etc.)）

[Schedule for the 2026 Academic Year]
The classes will be conducted in person on Fridays during the 5th period in Lecture Room W3, Research Building 9.
*Note: The 3rd lecture will be held in Lecture Room W301, Research Building 9 (subject to change in lecture room).
- Orientation: October 2
- Fundamentals of Group Work: October 16
- Special Lectures, In-Person Group Work: October 9, 23, 30; November 6, 15, 27; December 4, 11, 18, 25; January 8
- Camp: December 5 (Sat) 13:00 - December 6 (Sun) 13:00 @ AWL Keihoku
- Preliminary Review Session: January 15
- Final Presentation: January 16 (Sat)

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) (4)↓↓↓

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) (4)

*Please note that whether the credits earned are recognized as necessary for graduation depends on your undergraduate school. Refer to your undergraduate school course guide for more information.
*Registration for the course is not through KULASIS but via the following page. It is scheduled to open around September 2026:
https://www.t.kyoto-u.ac.jp/fs/erc/2026Fall_GL_seminar2
*An additional instructor may be assigned.

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

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

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

[Essential courses]

Course number	U-ENG25 35018 LJ75　U-ENG25 35018 LJ77　U-ENG25 35018 LJ71		
Course title (and course title in English)	量子物理学１（材原宇）〈情報〉 Quantum Physics 1	Instructor's name, job title, and department of affiliation	Part-time Lecturer,Itoh Akio

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Fri.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Quantum theory is one of the most successful theories in the modern physics. It explains well a lot of peculiar phenomena which can not be understood within the classical theory. The main purpose of this course is to understand the fundamental mathematical structure of the quantum theory.
We may use online materials. Check LMS in advance.

[Course objectives]

An important purpose of this course is to understand the fundamental mathematical structure of the quantum theory. In addition one is hoped to become capable to calculate some basic properties of a quantum mechanical particle on one-dimensional space.

[Course schedule and contents]

1. Introduction. Wave mechanics and matrix mechanics.
2. Mathematical structure of quantum theory (1) State and observable.
3. Mathematical structure of quantum theory (2) Hilbert space and state vectors.
4. Mathematical structure of quantum theory (3) operators and observables
5. Mathematical structure of quantum theory (4) Schroedinger equation and time evolution
6. One particle on one-dimensional space (1) classical theory and its quantization
7. One particle on one-dimensional space (2) CCR and Robertson's uncertainty relation
8. Potential problem (1) General theory
9. Potential problem (2) General theory and its mathematical addendum
10. Square well potential
11. Box potental
12. Scattering theory
13. Harmonic oscillator (1)
14. Harmonic oscillator (2)
15. Summary

[Course requirements]

Classical mechanics, Linear algebra

Continue to 量子物理学１（材原宇）〈情報〉(2)↓↓↓

量子物理学１（材原宇）〈情報〉(2)

[Evaluation methods and policy]

【Evaluation method】
Evaluation will be based on reports.
【Evaluation policy】
The result of reports should be 60 and above out of 100.
60 and above: Passed
59 and below: Failed

[Textbooks]

Not used

[References, etc.]

（Reference books）
Modern Quantum Mechanics (J.J.Sakurai) isbn{}{9780805382914} isbn{}{9781292024103}
Lectures on Quantum Theory (C.J. Isham) isbn{}{1860940013}

[Study outside of class (preparation and review)]

Clarify what you have learnt and what you do not understand. Solve a problem set which will be distributed.

（Other information (office hours, etc.)）

Send an email.

*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

[Essential courses]

Faculty of Engineering,Engineering Science

Course number	U-ENG25 45019 LJ71　U-ENG25 45019 LJ75　U-ENG25 45019 LJ77		
Course title (and course title in English)	量子物理学２（材原宇）〈情報〉 Quantum Physics 2	Instructor's name, job title, and department of affiliation	Part-time Lecturer,Itoh Akio

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Tue.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Quantum theory is an astonishing theory. It describes perfectly a lot of phenomena inspite of its peculiar mathematical formulation.
An important purpose of this course is to understand the formulation and to become capable to manipulate it.
We may use online materials. Check LMS in advance.

[Course objectives]

To understand the fundamental structure of quantum theory.
To be able to calculate some properties of quantum mechanical particle in three dimensional space.

[Course schedule and contents]

1. Fundamental framework
2. Angular momentum (1)
3. Angular momentum (2) generator of space rotation
4. Eigenvalue of Angular momentum operator. SU(2) and SO(3)
5. Spin
6. Central potential
7. Hydrogen atom
8. perturbation theory (1)
9. perturbation theory (2)
10. Heisenberg equation
11. Interaction picture
12. Bell's inequality
13. Mixed state
14. Many particle and Quantum field
15. Applications to quantum information

[Course requirements]

Quantum Physics 1

[Evaluation methods and policy]

【Evaluation method】
Evaluation will be based on reports.
【Evaluation policy】

Continue to 量子物理学２（材原宇）〈情報〉(2)↓↓↓

量子物理学２（材原宇）〈情報〉(2)

The result of reports should be 60 and above out of 100.
60 and above: Passed
59 and below: Failed

[Textbooks]

Not used

[References, etc.]

（Reference books）

Modern Quantum Mechanics (J.J.Sakurai) isbn{}{9780805382914} isbn{}{9781292024103}
Lectures on Quantum Theory (C.J. Isham) isbn{}{1860940013}

[Study outside of class (preparation and review)]

Solve a distributed problem set.

（Other information (office hours, etc.)）

Send an email.

*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

[Essential courses]

Faculty of Engineering,Engineering Science

Course number	U-ENG25 25300 LJ77　U-ENG25 25300 LJ71		
Course title (and course title in English)	エレクトロニクス入門（機宇）〈情報〉 Introduction to Electronics	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	2026/First semester

Days and periods	Mon.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

In this course, students will learn about the basic characteristics of electronic circuits, digital circuits that are indispensable in today's information society, and computer architecture as hardware for running programs.

[Course objectives]

In this course, students will learn the minimum level of electronic circuits required for research in the Department of Physics and the Department of Computer Science, and as researchers and engineers.

[Course schedule and contents]

The order and number of lectures for each topic are not fixed, and are subject to change by the lecturer depending on the lecture policy of the instructor and the background and understanding of the students.

* Fundamentals of Electronic Circuits (3 clases) Learn DC, AC, and transient analysis.
* Amplification Circuits (1 class) Learn about amplification circuits using operational amplifiers.
* Fundamentals of digital logic circuits (1 class) Learn fundamentals of logic circuits including Boolean algebra, Karnaugh diagrams, etc.
* Sequential circuits (1 class) Learn how to construct circuits with internal states.
* Circuit Delay (1 class) Learn about what determines the operating speed of a circuit.
* Digital representation of numbers (1 class) Learn how to represent numbers including floating point format, which is often used in scientific and technological calculations.
* Arithmetic logic circuits (1 class) Learn about the structure of arithmetic circuits for digitally represented numbers.
* Overview of computer architecture (1 class) Learn about the configuration of computers, the hardware that executes programs.
* Machine language (1 class) Learn about the relationship between high-level languages such as C and instructions that can be interpreted by hardware.
* Composition of computer architecture (2 classes) Learn about the composition and operation of computers, using a processor that can execute simple instructions as an example.
* Integrated circuit manufacturing process (1 class)
* Feedback (1 class)

Translated with www.DeepL.com/Translator (free version)

Continue to エレクトロニクス入門（機宇）〈情報〉(2)↓↓↓

エレクトロニクス入門（機宇）〈情報〉(2)

[Course requirements]

Students who do not specialize in electrical and electronic engineering can take this course if they have some prior knowledge of high school physics.

[Evaluation methods and policy]

Multiple report assignments will be given during the course to evaluate the achievement of the objectives.

[Textbooks]

Not used

[References, etc.]

（Reference books）

Introduced during class

[Study outside of class (preparation and review)]

Students are required to review mathematical expressions using complex numbers in advance.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Engineering Science

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	2026/First semester

Days and periods	Fri.2	Class style	Lecture (Face-to-face course)	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.

Continue to 電子回路(2)↓↓↓

電子回路(2)

Oscillators (2 times):
The principle of the oscillator circuit is lectured as a concept of the positive feedback. Various oscillator circuits are introduced with their characteristics.

Others (1 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 LMS.

[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/2026-110-6010-000) 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 homepage of this course is located on LMS (https://panda.ecs.kyoto-u.ac.jp/portal/).

Continue to 電子回路(3)↓↓↓

電子回路(3)

Contact the instructor after the lecture, when the students have any questions. The students may send questions to the instructor via e-mail at any time.

The office hour is shown in KULASIS.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

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,KODA YUSUKE

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.1	Class style	Lecture (Face-to-face course)	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.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

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,SUSUKI YOSHIHIKO 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	2026/First semester

Days and periods	Mon.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Power electronics is the academic field concerning the conversion and control of electrical power using semiconductor devices. Power conversion and control technologies are foundational technologies that support our lives and society at the hardware level, spanning electronic devices, computing devices such as CPUs and GPUs, robots, electric vehicles, data centers, and power systems based on renewable energy. This lecture is intended for students in the Undergraduate School of Electrical and Electronic Engineering and the Undergraduate School of Informatics and Mathematical Science. It explains the fundamentals of power engineering, power conversion technology, and its control techniques. Specifically, it covers the basics of switching circuits, the fundamentals of various power conversion technologies (DC-DC, AC-DC, DC-AC) and their control techniques, applications to motors, electric vehicles, and power systems, and the fundamentals of AC power transmission (three-phase transmission, stability).

[Course objectives]

- Be able to explain the fundamental concepts of power engineering, power conversion technology, and their control techniques, based on electrical and electronic circuits and system control.
- Be able to form opinions and engage in research regarding the relationship between electrical and electronic engineering, information science and technology, and society, from the perspective of electrical energy.

[Course schedule and contents]

1. Overview of Electrical Power Engineering and Power Electronics (1 session)
2. Fundamentals of Switching Circuits (1 session)
3. Fundamentals of DC-DC Conversion (Converters), Control/Implementation Techniques and Applications (4 sessions)
4. Fundamentals of AC Power Transmission (Three-Phase Circuits, Stability) (2 sessions)
5. Fundamentals and Applications of AC-DC Conversion (Rectifiers) (2 sessions)
6. Fundamentals and Applications of DC-AC Conversion (Inverters) (2 sessions: includes lecture in English)
7. Advanced Applications for Motor Drives, Electric Vehicles, etc. (1 session: lecture in English)
8. Advanced Applications in Power Systems, Railways, etc. (1 session: Lecture by practitioners)
9. General Overview (Feedback Session) (1 session)

[Course requirements]

Electrical and Electronic Engineering: Fundamentals of Electrical Circuits, Electrical and Electronic Circuits, Electronic Circuits
Informatics and Mathematical Science: Introduction to Electrical and Electronic Circuits, Vibration and Wave

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)

[Evaluation methods and policy]

Achievement of learning objectives will be evaluated through exams, reports, and other assessments. A passing grade will be awarded to students demonstrating a general understanding of at least 60% of the lecture content. The final grade is determined based on the exam score (80%) and other factors (20%). Any changes to this ratio will be announced to students. No remedial measures, such as report submissions, will be offered after the final exam.

[Textbooks]

Lecture notes will be posted at LMS.

[References, etc.]

（Reference books）

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

（Related URLs）

(Lecture data are offered on kulasis or LMS.)

[Study outside of class (preparation and review)]

N/A

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

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	2026/First semester

Days and periods	Wed.4	Class style	Lecture (Face-to-face course)	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]

竹内繁樹『量子力学講義ノート』（サイエンス社,2024年）ISBN:978-4-7819-1597-5（ This textbook is written in Japanese.）

[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.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

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,YOSHII KAZUYOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course focuses on signal and function approximation, covering both theoretical foundations and engineering applications from two perspectives: linear algebra/functional analysis and statistical inference/ machine learning. The transformation and approximation of measurement data are fundamental to engineering. In particular, the concepts of linear spaces and linear mappings form the foundation of various theories in electrical, electronic, and information engineering.

[Course objectives]

This course enables students to acquire fundamental knowledge applicable to various subjects such as signal processing, image processing, automatic control engineering, and communication theory, as well as a universal and unified perspective that applies across different research fields.

[Course schedule and contents]

Linear Spaces and Linear Mappings (2 sessions):
Reviews linear algebra, explaining the concepts of linear spaces and linear mappings beyond mere matrix calculations. Introduces norms and inner products on linear spaces, describing their properties as metric linear spaces. Also explains data (vector) representation using bases and their relationship to eigenvalue problems.

Function Spaces and Linear Operators (2 sessions):
Explains infinite-dimensional vector spaces (function spaces) containing signals and functions as elements, extending from finite-dimensional vector spaces. Introduces representative function spaces and explains convergence, Cauchy sequences, and completeness. Also covers mappings (operators), projections, orthogonality, and orthogonalization in function spaces, along with function approximation problems using orthogonal systems and their completeness.

Bases of Linear Spaces (3 sessions):
Explains bases in linear spaces. Covers orthogonal bases, Gram-Schmidt orthogonalization, and their relationship to linear mappings. Explains Principal Component Analysis (PCA) as a method of constructing linear mappings using orthogonal bases from both function approximation and statistical inference perspectives. Also covers Independent Component Analysis (ICA) for constructing linear mappings using non-orthogonal bases.

Bases of Function Spaces (2 sessions):
Explains bases in function spaces. Covers function systems frequently used in signal processing, such as trigonometric and Haar function systems. Shows how Legendre, Laguerre, and Hermite polynomial systems

Continue to 電気電子数学２(2)↓↓↓

are uniformly generated through function orthogonalization. Also explains spherical harmonics as orthogonal basis systems on spheres and introduces their engineering applications.

Signal Transformation (2 sessions):
Explains function expansion as a method of signal representation. Covers generalized Fourier series extending trigonometric systems and their convergence, explaining least-squares approximation of continuous periodic signals from both function approximation and statistical inference perspectives. Also derives Fourier transforms as limits of Fourier series and explains Fourier transforms of representative functions including delta functions, step functions, and Gaussian functions.

Signal Learning (3 sessions):
Explains learning of signal dynamics. Provides unified explanation of formulation, inference, and learning of Hidden Markov Models (HMM) and Linear Dynamical Systems (LDS) for discrete signals from maximum likelihood criterion perspective. LDS is also explained from control theory perspective. Covers applications to electrical and electronic engineering problems incorporating differential equations.

Learning Achievement Confirmation (1 session):
Dedicated to confirming learning achievement of the above content.

*Content and schedule may change depending on class progress and student understanding.

[Course requirements]

Linear algebra

[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.

Continue to 電気電子数学２(3)↓↓↓

電気電子数学２(3)

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

Course number	U-ENG26 36207 LJ72				
Course title (and course title in English)	電気電磁回路 Electric and Electromagnetic Circuits	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Program-Specific Professor,HISAKADO TAKASHI		
Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester
Days and periods	Tue.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

高速動作する回路の基本となる分布定数回路の基礎理論と集中定数回路の過渡現象ならびに電磁波の放射や誘導に関する基礎について講述する．また，電気回路を通して，ソフトウェアとハードウェアが結び付けられ，サイバーフィジカルシステムとして様々な機能が実現できることを学ぶ.

[Course objectives]

集中・分布定数回路における過渡現象，正弦波定常現象を理解する．また，分布定数線路や微小ダイポールアンテナにおける電磁波の考え方ろ理解する．さらに，これらの回路（ハードウェア）のダイナミクスに基づいて，ソフトウェアを用いた様々な機能が実現できることを理解する.

[Course schedule and contents]

分布定数回路と集中定数回路,1回
一本の往復線路は分布定数回路として取り扱うこともできるし，集中定数回路と見なすこともできる．それは何に帰因するのかを説明する.
分布定数線路の過渡現象,5回
分布定数線路の方程式を Faraday の法則と Ampere の周回積分の法則から導いた後，ステップ状の電源電圧／電流が印加された場合に対する取り扱い，種々の終端条件の下での解析法について説明する.
分布定数線路の正弦波定常現象,3回
分布定数線路に交流電源が印加された場合の取り扱い方を定量的に述べる.
複素周波数を用いた過渡現象の解析,2回
ラプラス変換による回路網の過渡現象の解析法を説明する.
電磁波の放射と誘導の基礎,1回
サイバーフィジカルシステムとしての電気回路，1回
講義のまとめ，1回
学習到達度の確認,1回
本講義の内容に関する到達度を確認する。

[Course requirements]

「電気回路基礎論」または「電気電子回路入門」や「エレクトロニクス入門」の講義内容

Continue to 電気電磁回路(2)↓↓↓

電気電磁回路(2)

[Evaluation methods and policy]

期末試験（定期試験）の成績による.
講義時に適宜，レポート課題を出題し，そのレポート評価を最終評価に加える.

[Textbooks]

プリント使用

[References, etc.]

（Reference books）
小沢孝夫: 電気回路II (昭晃堂) isbn{}{4785610883},
奥村浩士：電気回路理論（朝倉書店） isbn{}{9784254220490}

[Study outside of class (preparation and review)]

配布資料ならびにノートを整理し、各自で講義内容を復習すること。
MATLAB,LTspice,Analog Discovery 2**を適宜使用する。**

（Other information (office hours, etc.)）

オフィスアワー：火曜４限、S101**にて**

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Electrical and Electronic Engineering

Course number	U-ENG29 29017 LJ11		
Course title (and course title in English)	プログラミング言語（計算機） Programming Languages	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,IGARASHI ATSUSHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Mon.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to プログラミング言語（計算機）(2)↓↓↓

プログラミング言語（計算機）(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29022 SJ11		
Course title (and course title in English)	計算機科学実験及演習２（計算機） Computer Science Laboratory and Exercise 2	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,DING, Shiyao Academic Center for Computing and Media Studies Associate Professor,KONDO KAZUAKI Graduate School of Informatics Assistant Professor,WAGA MASAKI Graduate School of Informatics Assistant Professor,INOUE KOJI Graduate School of Informatics Assistant Professor,NAGANO MASATOSHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Tue.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,7times,
,7times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 計算機科学実験及演習２（計算機）(2)↓↓↓

計算機科学実験及演習２（計算機）(2)

[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.

[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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39025 LJ10　U-ENG29 39025 LJ55		
Course title (and course title in English)	数値解析 Numerical Analysis	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,FUJIWARA HIROSHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Wed.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,6times,
,3times,
,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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39028 LJ10　U-ENG29 39028 LJ55		
Course title (and course title in English)	確率と統計 Probability and Statistics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Shimodaira, Hidetoshi

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course involves the basics of probability and statistics. The probability theory is illustrated through random number generation. Theory and applications of statistical inference, such as Bayesian inference and maximum likelihood method, are then discussed.

[Course objectives]

To understand the basics of probability and statistics from the viewpoints of mathematics, algorithm, and applications.

[Course schedule and contents]

Monte Carlo methods,6times,Random number generation from probability distribution: inverse transform sampling, rejection sampling, Markov chain Monte Carlo (Metropolis-Hastings sampler, Gibbs sampler). Simulation of the model of ferromagnetism. The basics of probability (probability distribution, density function, the law of large numbers, the central limit theorem).
Bayesian inference,4times,Statistical inference with Bayes method. Image restoration via Bayesian inference with Markov chain Monte Carlo. Classification via Bayesian discriminant analysis with an application to spam mail filter. The error rate of Bayes classifier.
The methods of least squares and maximum likelihood,5times,Theory of statistical inference including the following topics. Multiple regression analysis with least squares and weighted least squares. Logistic regression analysis via maximum likelihood method. The asymptotic distribution of the maximum likelihood estimator (MLE). Hypothesis testing and model selection. Additional topics including multivariate analysis (principal component analysis, canonical correlation analysis).

[Course requirements]

None

[Evaluation methods and policy]

Grading is based on papers and final exam.

Continue to 確率と統計(2)↓↓↓

確率と統計(2)

[Textbooks]

Handouts may be distributed in class.

[References, etc.]

（Reference books）

C. M. Bishop: Pattern Recognition and Machine Learning, Springer. isbn{}{9780387310732}
T. Hastie, R. Tibshirani, and J. Friedman: The Elements of Statistical Learning, Springer. isbn{}{0387952845} isbn{}{9780387848570} isbn{}{9780387848587}

[Study outside of class (preparation and review)]

In addition to attending class, work at home including real data analysis is required.

（Other information (office hours, etc.)）

Details of office hours will be notified at class.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

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

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Thu.4	Class style	Lecture (Face-to-face course)	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（計算機）(2)↓↓↓

グラフ理論（計算機）(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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29030 LJ10		
Course title (and course title in English)	グラフ理論（数理） Graph Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KAMIYAMA NAOYUKI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Thu.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

After basic notations and properties on graphs and networks are given, algorithms to some representative problems such as the shortest path problem, the minimum spanning tree problem and the maximum flow problem are described. Applications of these results and extensions of them in discrete mathematics are also presented.

[Course objectives]

Not only to learn the notions on graph structure as knowledge but to understand proofs to mathematical properties on discrete structures and logical mechanisms in computational methods

[Course schedule and contents]

graphs and networks ,1time,Basic terminology on graphs and networks are defined, and some representative problems such as the Eulerian trail problem, the Hamiltonian cycle problem and the graph isomorphism problem are introduced.
connectivity,1time,Graph connectivity such as k-connectivity of undirected graphs and strong connectivity of digraphs are defined and some properties for them are derived.
plane graphs and dual graphs,2times,Some combinatorial aspects of graphs such as Kratowski#039s theorem, which characterizes the planar graphs, duality of plane graphs, the four-color theorem are described.
representation for graphs,1time,As representation for data to input graphs, matrix and adjacency lists are introduced.
graph search,2times,The depth first search and the width first search are introduced, and as their applications, an algorithm for computing cut-vertices and biconnected components is designed.
shortest path ,2times,Properties on shortest paths and Dijkstra#039s method, as a representative shortest path algorithm, are described.
trees and cut-sets,1time,Important properties on spanning trees and cut-sets, especially the roles of fundamental cycles and fundamental cut-sets are described.
minimum spanning tree ,1-2times,Kruskal#039s method and Prim#039s method, as representative minimum spanning tree algorithms, are described, and data structure for them and their computational complexities are discussed.
maximum-flow ,2times,The maximum-flow and minimum-cut theorem in networks and an algorithm for finding a maximum flow are described.

Continue to グラフ理論（数理）(2)↓↓↓

グラフ理論（数理）(2)

[Course requirements]

None

[Evaluation methods and policy]

Evaluation is made based on marks on answers in exercises (30%) and score of end-term examination (70%)

[Textbooks]

[References, etc.]

（Reference books）

C ni yoru Algorithms to Data Structure, Ibaraki, Shokou-do isbn{}{4785631171} isbn{}{9784274216046}

（Related URLs）

(Necessary materials are uploaded at http://www-or.amp.i.kyoto-u.ac.jp/members/nag/)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Some exercises are conducted in each class. The answers to questions in exercises and end-term examination and the achievement attained by students to each question will be uploaded.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39031 LJ10　U-ENG29 39031 LJ55		
Course title (and course title in English)	応用代数学 Applied Algebra	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TSUJIMOTO SATOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Mon.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

An introduction with application to basic algebra in informatics.

[Course objectives]

To understand basic ideas and some applications of algebras (mainly group theory).

[Course schedule and contents]

Introduction to group theory,2-3times,Definition and examples of group: symmetric group, permutation group, cyclic group, general linear group and so on.
Structure of groups,4-5times,Subgroup, coset, normal subgroup, quotient group, the isomorphism theorems.
Symmetric group and enumeration problem,3-4times,Action of the symmetric group on a finite set. Enumeration problem.
Group representation,3-4times,Groups in terms of linear transformations of vector space.
Summary and assessment,1time,Summary and supplement of this course. Measure the progress of students in acquiring knowledge and skills.

[Course requirements]

Linear algebra

[Evaluation methods and policy]

Evaluation depends mainly on marks of examination, but marks of exercises are taken into account when needed.

[Textbooks]

Continue to 応用代数学(2)↓↓↓

応用代数学(2)

[References, etc.]

（Reference books）

T. Hiramatsu: Joho no suri oyo daisugaku (Shokabo) isbn{}{4785315040}

（Related URLs）

(http://www-is.amp.i.kyoto-u.ac.jp/lab/tujimoto/appalg/)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39039 SJ12　U-ENG29 39039 SJ13　U-ENG29 39039 SJ11		
Course title (and course title in English)	計算機科学実験及演習４（計算機） Computer Science Laboratory and Exercise 4	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,Drazen Brscic Graduate School of Informatics Associate Professor,IMOTO KEISUKE Academic Center for Computing and Media Studies Assistant Professor,SHIMONISHI KEI Graduate School of Informatics Associate Professor,TAKEUCHI KOH Academic Center for Computing and Media Studies Associate Professor,KONDO KAZUAKI

Target year	3rd year students or above	Number of credits	3	Year/semesters	2026/Second semester

Days and periods	Thu.3,4,Fri.1,2,3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,15times,
,15times,
,15times,
,15times,
,15times,
,15times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

Continue to 計算機科学実験及演習４（計算機）(2)↓↓↓

計算機科学実験及演習４（計算機）(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

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

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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39055 LJ11　U-ENG29 39055 LJ10		
Course title (and course title in English)	アルゴリズム論 Theory of Algorithms	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,MINATO SHINICHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Thu.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Not used

[References, etc.]

（Reference books）

Introduced during class

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39058 LJ72　U-ENG29 39058 LJ10		
Course title (and course title in English)	現代制御論（数理） Modern Control Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KASHIMA KENJI Graduate School of Informatics Professor,MORIMOTO JUN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course provides the fundamentals in modern control theory - centered around the so-called state space methods - as a continuation of classical control theory taught in Linear Control Theory. Emphasis is placed on the treatment of such concepts as controllability and observability, pole allocation, the realization problem, observers, and linear quadratic optimal regulators.

[Course objectives]

The objective is to study controllability and observability that are the basis of modern control theory, and also understand design methods such as optimal regulators. It is hoped that the course provides a basis for a more advanced topic such as robust control theory.

[Course schedule and contents]

Introduction to modern control,1time,We give real examples for which the modern control theory are applied. We also give a state-space formulation for modeling dynamical systems.
Mathematics for modern control,1time,We discuss some fundamental properties of mathematics, in particular, vectors and matrices.
Controllability and observability,2times,We introduce the fundamental notions of controllability and observability for linear dynamical systems, and also discuss their basic properties and their criteria.
Canonical decomposition,2times,We give the canonical decomposition for linear systems.
Realization problem,2times,We introduce the realization problem that constructs state space representations from transfer functions for single-input and single-output systems.
Stability,2times,We discuss the stability of dynamical systems described by state-space equations. We also give mathematical tools for checking if a system is stable or not.
State feedback and dynamic compensators,2times,We introduce the construction of dynamic compensators via state feedback, pole allocation and observers. The relationships with controllability and observablity are also discussed.
Opimal regulators,2times,We give the basic construction of optimal regulators, in particular, the introduction of the matrix Riccati equation, its solvability, relationship to stability and observability, and root loci.
Overall summary, 1time

Continue to 現代制御論（数理）(2)↓↓↓

現代制御論（数理）(2)

[Course requirements]

It is desirable that the student has studied classical control theory (linear control theory). Fundamental knowledge on linear algebra is assumed, e.g., matrices, determinants, rank of a matrix, dimension of a vector space, isomorphism.

[Evaluation methods and policy]

The grading is based on the evaluation of reports and final examination.

[Textbooks]

None specified.

[References, etc.]

（Reference books）

Linear Algebra, K. Jaenich, translation by M. Nagata, Gendai-suugakusha, isbn{}{4768703194}
Mathematics for Systems and Control, Y. Yamamoto, Asakura, isbn{}{4254209762}

[Study outside of class (preparation and review)]

Fundamental knowledge of linear algebra such as matrix manipulation is assumed.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29070 LJ55　U-ENG29 29070 LJ10　U-ENG29 29070 LJ11		
Course title (and course title in English)	論理システム（計算機） Logical Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,MINATO SHINICHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

In this course, we learn about symbolic logic and Boolean algebra, the basis of computer science, and about logic circuits, the basis of digital machine configurations. We first study symbolic logic, especially propositional logic. Next, we take up Boolean algebra, its various characteristics (properties); meanwhile, students will gain logic function simplification methods. We further study the design and analysis of combinational logic circuits, as well as sequential circuits and their models, sequential machines.

[Course objectives]

1. Students will understand and be able to explain propositional logic.
2. Students will understand and be able to explain the fundamental concepts and various characteristics of Boolean algebra and logic functions.
3. Students will understand and be able to use logic function simplification methods.
4. Students will understand and be able to explain the fundamental concepts and design methods of combinational logic circuits and sequential circuits.

[Course schedule and contents]

Mathematical preparation (1 class)
A review of knowledge necessary for this course, including sets, relationships, etc.

Symbolic logic (1 class)
Students learn about propositional logic, together with an overview of symbolic logic.

Boolean algebra and logic functions (2 classes)
Students learn about Boolean algebra and logic expressions, as well as about logic functions and their expressions, etc.

Simplification of logic functions (2 classes)
Students learn about the simplification of logic functions.

Various characteristics of logic functions (2 classes)
Students learn about the various properties of logic functions and about logic functions that have special characteristics.

Design and analysis of combinational circuits (2 classes)

Continue to 論理システム（計算機）(2)↓↓↓

論理システム（計算機）(2)

Students learn about design methods and analysis methods for combinational circuits.

Sequential machines and sequential circuits (4 classes)
Students learn about design methods for sequential circuits, and especially regarding the minimization of, and state allocation for, sequential machines.

Term-end examination (1 class)

Feedback (1 class)
Review, including of the problems on the final examination, etc.

[Course requirements]

None

[Evaluation methods and policy]

Evaluation is performed regarding each element of this course's end goals, namely, the final examination (approximately 90%) and exercises (approximately 10%). If an understanding is shown of 80% or higher on the final exam, then the student will pass the course.

[Textbooks]

Naofumi Takagi 『Logic circuits』 （Ohm-sha）ISBN:9784274215995

[References, etc.]

（Reference books）

Zvi Kohavi, Niraj K. Jha 『Switching and Finite Automata Theory, Third Ed.』 （Cambridge University Press, 2010）ISBN:0521857481, 9780521857482

（Related URLs）

http://www.lab3.kuis.kyoto-u.ac.jp/~ntakagi/ls.html

[Study outside of class (preparation and review)]

Students are to read assigned textbook portions to prepare for each class.
Students are to solve the problem exercises assigned during each class and to submit each week's problems before the next class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Continue to 論理システム（計算機）(3)↓↓↓

論理システム（計算機）(3)

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29070 LJ55　U-ENG29 29070 LJ10　U-ENG29 29070 LJ11		
Course title (and course title in English)	論理システム（数理） Logical Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,FUKUDA HIDEMI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

The student will learn the basics of mathematical logic, in particular, associated to propositional logic, Boolean algebra, digital circuits and related topics.

[Course objectives]

Learn the basics of mathematical logic, which is the principle of computational science.

[Course schedule and contents]

[Topics]
Mathematical logic, Boolean algebra; logic circuits
- Class 1 to 3: An overview of topics related to mathematical logic is provided. Propositional logic is introduced.
- Class 4 to 6: Starting from the definition of lattices, the definition of Boolean algebras and examples are presented.
- Class 7 to 8: Methods for representing logical functions and techniques for simplifying logical expressions are explained.
- Class 9: Methods for representing information, as well as the representation and conversion of numbers, are explained.
- Class 10 to 14: Applications of Boolean algebra to the analysis and construction of logic circuits are explained, with a focus on combinational logic circuits. In addition, methods for analyzing logic circuits and various ways of utilizing different circuits are discussed.
[Final examination]
- Class 15: Feedback

[Course requirements]

None

[Evaluation methods and policy]

Defined based only on the final test.

Continue to 論理システム（数理）(2)↓↓↓

論理システム（数理）(2)

[Textbooks]

Instructed during class

[References, etc.]

（Reference books）
高木直史『論理回路』（オーム社）ISBN:978-4274215995
天野英晴, 武藤佳恭, 相磯秀夫『だれにもわかる ディジタル回路』（オーム社）ISBN:978-4274217531

[Study outside of class (preparation and review)]

No preparation in advance is required, but the review of previous classes is recommended.

（Other information (office hours, etc.)）

Prof. Ellen Hidemi Fukuda: ellen [at] i.kyoto-u.ac.jp
Please change [at] to @.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29071 LJ57　U-ENG29 29071 LJ10		
Course title (and course title in English)	解析力学（数理） Analytical Mechanics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TAGUCHI Satoshi

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,7times,
,8times,
,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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39072 LJ72　U-ENG29 39072 LJ10		
Course title (and course title in English)	線形制御理論 Linear Control Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KASHIMA KENJI Graduate School of Informatics Professor,MORIMOTO JUN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Wed.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

In this course, we will learn the basics of feedback control theory which has wide range of applications such as drones, automatic driving, systems biology. We will give lectures on analysis of feedback systems, stability criterion, servo mechanism design, and so on, based on Laplace transform.

[Course objectives]

The goal of this course is to understand the basics on analysis of feedback systems and to acquire frequency-domain methods for control systems design.

[Course schedule and contents]

Introduction,1time,
Laplace transform,2times,
System modeling and transfer function,2times,
Transient response and stability,3times,
Frequency response,2times,
Stability analysis of feedback systems,2times,
Characteristics of feedback control systems,2times,
Summary,1time,

[Course requirements]

It is recommended, but not required, that students take Introduction to Systems Analysis (90070) and Applied Mathematics A3 (20700) before taking this course.

[Evaluation methods and policy]

The final grade in this course is based on your scores in reports and the final examination.

[Textbooks]

None.

[References, etc.]

（Reference books）

T. Sugie and M. Fujita: Introduction to Feedback Control (in Japanese). Corona Publishing, 1999 isbn{}{ 4339033030}

Continue to 線形制御理論(2)↓↓↓

線形制御理論(2)

T. Katayama: Fundamentals of Feedback Control: New edition (in Japanese). Asakura Publisher, 2002 isbn{}{4254201117}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39074 LJ55　U-ENG29 39074 LJ10		
Course title (and course title in English)	数理工学セミナー（数理） Seminar on Applied Mathematics and Physics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,TSUTSU HIROKI Graduate School of Informatics Assistant Professor,KOBAYASHI KATSUKI Graduate School of Informatics Assistant Professor,HARADA KENJI Graduate School of Informatics Associate Professor,TERAMAE JUNNOSUKE Graduate School of Informatics Assistant Professor,YAMAGUCHI YOSHIYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Fri.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

It is a seminar-type class, related to various topics related to Applied Mathematics and Physics.

[Course objectives]

Each student will learn an specific topic of his/her choice. During the class, the students will learn not only the topic itself, but how to present it appropriately.

[Course schedule and contents]

- 15 classes in total including feedback class.
- 6 topics, related to General Mathematics, General Physics, Operations Research and Control Theory, will be provided.
- Each student will choose one topic only.

[Course requirements]

It will depend on the topic chosen by the student. Please read the information that will be posted on Kulasis in July.

[Evaluation methods and policy]

- Each student should attend all classes. If, for some reason, he/she cannot attend some classes, he/she should tell the instructor in advance.
- The grades will be based on the attendance, communication during the class, presentation, and understanding of the topic.

[Textbooks]

It depends on the topic of choice.

[References, etc.]

（Reference books）

It depends on the topic of choice.

Continue to 数理工学セミナー（数理）(2)↓↓↓

数理工学セミナー（数理）(2)

[Study outside of class (preparation and review)]

Please ask the instructor of your topic.

（Other information (office hours, etc.)）

In early July, all the topics of this seminar class will be announced. Students should pay attention to KULASIS and/or to the announce board of the department office. After that, the students should follow the instructions of this announcement, which includes choosing the topic of interest.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39079 LJ54　U-ENG29 39079 LJ10		
Course title (and course title in English)	最適化（数理） Optimization	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,YAMASHITA NOBUO Graduate School of Informatics Professor,KAMIYAMA NAOYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Mathematical programming or optimization is a methodology for modeling a real-world problem as a mathematical problem with an objective function and constraints, and solving it by some suitable procedure (algorithm). This course consists of lectures on basic theory and methods in nonlinear optimization and combinatorial optimization.

[Course objectives]

To understand basic theory and algorithms in continuous optimization and combinatorial optimization.

[Course schedule and contents]

Fundamentals of nonlinear optimization,2times,Basic notions in continuous optimization such as global and local minima, convex sets and functions, gradients and Hessian matrices of multivariate functions.
Method of unconstrained optimization,2times,Basic unconstrained optimization methods such as steepest descent method, Newton#039s method, quasi-Newton methods, conjugate gradient method.
Optimality conditions and duality,2times,Optimality conditions for constrained optimization problems, called Karush-Kuhn-Tucker conditions, as well as the second-order optimality conditions and Lagrangian duality theory.
Methods of constrained optimization,1time,Basic methods of constrained optimization such as penalty methods and sequential quadratic programing methods.
Combinatorial optimization,1time,Typical combinatorial optimization problems such as traveling salesman problem and knapsack problem, and their computational complexity.
Branch-and-bound method and dynamic programming,2times,Basic exact solution strategies for combinatorial optimization such as branch-and-bound method and dynamic programming.
Approximation algorithms,3times,Approximation algorithms for hard combinatorial optimization problems, and their theoretical performance guarantees.
Summary and review,1time,Summary and review. Confirment of achievement level.

[Course requirements]

Linear Programming (90690) recommended.

Continue to 最適化（数理）(2)↓↓↓

最適化（数理）(2)

[Evaluation methods and policy]

Based on the score of the term examination.

[Textbooks]

Not used

[References, etc.]

（Reference books）

M. Fukushima, Introduction to Mathematical Programming: New Edition (in Japanese), Asakura Shoten isbn{}{9784254280043};

M. Yagiura and T. Ibaraki, Combinatorial Optimization - Metaheuristic Algorithms (in Japanese), Asakura Shoten isbn{}{4254275129}.

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39080 LJ10　U-ENG29 39080 LJ55		
Course title (and course title in English)	力学系の数学 Dynamical Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,SHIBAYAMA MITSURU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Dynamical systems represent general mathematical models such as differential equations for time-dependent phenomena and a mathematical field having originated in the work of the greatest mathematician in 19th century, Poincare. Dynamical systems theory provides tools to treat nonlinear phenomena such as bifurcations and chaos, and its application range is very wide since there are numerous time-dependent phenomena in natural and social sciences. This course provides fundamentals of dynamical systems theory with a special focus on differential equations.

[Course objectives]

(1) To understand dynamics of differential equations and maps near neighborhoods of equilibria and fixed points
(2) To understand mechanisms for nonlinear phenomena such as bifurcations and chaos
(3) To master fundamental techniques for dynamical systems

[Course schedule and contents]

Examples of Dynamical Systems, 1 time:
Classical dynamical systems given by differential equations and maps are considered and nonlinear phenomena occurred in numerical simulations of these systems are reviewed.
Introduction to Dynamical Systems, 5-6 times:
Fundamentals of differential equations are reviewed and elementary concepts such as Poincare maps, stability, dynamics of linear systems and invariant manifolds are explained.
Local Bifurcations, 4-5 times:
Bifurcations of equilibria and fixed points, center manifold reductions and normal forms are discussed.
Chaos, 3-4 times:
Horseshoe maps, homoclinic theorem and Melnikov's method are discussed.
Summary and learning achievement evaluation, 1 time:
A summary and supplements of this course are given and the learning achievement of students is evaluated.

[Course requirements]

Calculus, Linear Algebra and Differential Equations

Continue to 力学系の数学(2)↓↓↓

力学系の数学(2)

[Evaluation methods and policy]

Evaluation depends mainly on marks of mid-term examinations (20%) and final one (80%).

[Textbooks]

Handouts

[References, etc.]

（Reference books）

K.T. Alligood, T. Sauer and J.A. Yorke 『Chaos: An Introduction to Dynamical Systems』 （Springer） ISBN:9783642592812

M.W. Hirsch, S. Smale and R.L. Devaney 『Differential Equations, Dynamical Systems, and an Introduction to Chaos 』 （Elsevier, 2013） ISBN:9780123820105

J. Guckenheimer and P. Holmes 『Nonlinear Oscillations, Dynamical Systems, and Bifurcations of Vector Fields』 （Springer, 1983） ISBN:0387908196

J.D. Meiss 『Differential Dynamical Systems』 （SIAM, 2017） ISBN:9780898716351

S. Wiggins 『Introduction to Applied Nonlinear Dynamical Systems and Chaos』 （Springer, 2003） ISBN: 0387001778

[Study outside of class (preparation and review)]

Prepare and review the lectures and solving the problems given on KULASIS or LMS to understand the contents of the textbook and lectures.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39081 LJ10　U-ENG29 39081 LJ72		
Course title (and course title in English)	信号とシステム Signals and Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TANAKA TOSHIYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Thu.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 信号とシステム(2)↓↓↓

信号とシステム(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39084 SJ11		
Course title (and course title in English)	計算機科学実験及演習３（計算機） Computer Science Laboratory and Exercise 3	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,SUENAGA KOUHEI Graduate School of Informatics Associate Professor,KAWAHARA JUN Academic Center for Computing and Media Studies Associate Professor,YASUDO RYOTA Graduate School of Informatics Assistant Professor,WAGA MASAKI Graduate School of Informatics Assistant Professor,IKEBUCHI MIRAI Academic Center for Computing and Media Studies Associate Professor,KONDO KAZUAKI Graduate School of Informatics Assistant Professor,NAGANO MASATOSHI

Target year	3rd year students or above	Number of credits	4	Year/semesters	2026/First semester
Days and periods	Thu.3,4,5,Fri.1,2,3,4,5	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,15times,
,15times,
,15times,
,15times,

[Course requirements]

None

[Evaluation methods and policy]

Continue to 計算機科学実験及演習３（計算機）(2)↓↓↓

計算機科学実験及演習３（計算機）(2)

[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.

[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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39086 LJ10　U-ENG29 39086 LJ11		
Course title (and course title in English)	計算と論理 Logic and Computation	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,IGARASHI ATSUSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Tue.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,6times,
,7times,
,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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29090 SJ57　U-ENG29 29090 SJ10　U-ENG29 29090 SJ55		
Course title (and course title in English)	基礎数理演習（数理） Exercise on Applied Mathematics and Physics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,KOBAYASHI KATSUKI Graduate School of Informatics Assistant Professor,YAMAGUCHI YOSHIYUKI Graduate School of Informatics Assistant Professor,TSUTSU HIROKI Graduate School of Informatics Assistant Professor,HARADA KENJI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,

[Course requirements]

None

Continue to 基礎数理演習（数理）(2)↓↓↓

基礎数理演習（数理）(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29091 SJ54　U-ENG29 29091 SJ10　U-ENG29 29091 SJ11		
Course title (and course title in English)	プログラミング演習（数理:H30以前入学者） Exercise on Programming	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,YAMAGUCHI YOSHIYUKI Graduate School of Informatics Assistant Professor,YOSHIWATARI KANAE Graduate School of Informatics Assistant Professor,KAWAGOE DAISUKE

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Mon.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Ｃ言語によるプログラミング実習を行う。手続き型言語を用いたプログラミングの基礎となる、データ型・演算子・配列・関数・条件分岐・繰り返し処理・多次元配列・ファイル操作等を、数理工学での基礎的なアルゴリズム実装を題材にして学ぶ。

[Course objectives]

数理工学の各分野において、コンピュータを有効活用するために必要なプログラミングの知識と技術を修得する。

[Course schedule and contents]

第1回　ガイダンスとレポートの書き方
　　レポートの適切な書法と各種ツールの活用について学ぶ。

第2回～第4回　手続き型言語入門・条件分岐と繰り返し構造と関数
　　基本的な文法、基本的なデータ型、基本的な関数とそれを用いたサンプルプログラミングの実行方法までを学び、プログラムの基本パーツである条件分岐や繰り返し構造、関数について、数値積分（台形公式）、1変数非線形方程式の解法（ニュートン法）などのアルゴリズム実装を題材にして学ぶ。

第5回～第9回　多次元配列
　　多次元配列の使い方を、基本的な行列演算、行列固有値問題の数値解法（べき乗法）、常微分方程式の数値解法、線形方程式の数値解法（ガウスの消去法）などのアルゴリズム実装を題材に学ぶ。

第10回～第14回　データ構造とファイル操作
　　構造体、ポインタ、動的メモリ確保などをソーティングや動的計画法などのアルゴリズム実装を題材に学ぶ。さらに、ファイルからのパラメータ入力や結果の出力やリダイレクトを組み合わせたコード作成についても学ぶ。

第15回　学習到達度の確認
　　プログラミング技術の到達度を確認する。

Continue to プログラミング演習（数理:H30以前入学者）(2)↓↓↓

プログラミング演習（数理:H30以前入学者）(2)

[Course requirements]

本演習はBYODで行うため、演習時には各自ノートPCを持参すること。

[Evaluation methods and policy]

各項目ごとに出されるレポートに基づき総合的に成績評価を行う。

[Textbooks]

Not used

[References, etc.]

（Reference books）

柴田望洋 『新・明解C言語 入門編 第2版』（SBクリエイティブ）ISBN:978-4815609795

[Study outside of class (preparation and review)]

演習時間を有効的に活用するために、配布資料に基づく予習を行うこと。

（Other information (office hours, etc.)）

初回ガイダンスへの出席を必須とする。

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39094 LJ10　U-ENG29 39094 LJ57		
Course title (and course title in English)	物理統計学（数理） Statistical Physics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,UMENO KEN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Thu.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Probability theory, statistical mechanics, and theory of stochastic processes are explained as methods to investigate systems with many degrees of freedom. Technics for describing dynamics, and fluctuation in equilibrium or stationary systems and some topics for nonequiliburium systems are explained.

[Course objectives]

To gain firmly the fundamental skills for understanding various phenomena with the use of probability theory and stochastic process.

[Course schedule and contents]

Fundamentals of probability and entropy,3times,Continuous and discrete stochastic variables are introduced and entropy, KL entropy and mutual information are explained.
Fundamentals of statistical mechanics,3times,Fundamentals of thermodynamics are reviewed and statistical mechanics is formularized with the maximum entropy principle. Applications to ideal gases and spin systems are explained.
Stochastic processes and random walks,3times,Stochastic processes, especially Markov processes are explained. As examples, Gauss process, Poisson process, Wiener process and random walks are explained.
Langevin equaitons and Fokker-Planck equations,3times,Brownian motion is introduced as an example of Langevin equations. Derivation of Fokker-Planck equations from Langevin equations are described and several applications of both equations are explained.
Some topics for nonequiliburium systems,2times,We explain some topics chosen from entropy production in relaxation processes from nonequiliburium states to equilibrium states, the linear responce theory, the fluctuation theory, thermal excitation, diffusion and so on.

[Course requirements]

Fundamentals of calculus and linear algebra

[Evaluation methods and policy]

Based on quizzes and the semester final exam.

Continue to 物理統計学（数理）(2)↓↓↓

物理統計学（数理）(2)

[Textbooks]

None

[References, etc.]

（Reference books）

To be announced in the lecture

[Study outside of class (preparation and review)]

Reviews through solving the assigned quizzes are expected.

（Other information (office hours, etc.)）

According to progress of the lecture, some topics may be omitted or added.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39096 LJ10　U-ENG29 39096 LJ55		
Course title (and course title in English)	確率離散事象論 Stochastic Discrete Event Systems	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,HONDA JUNYA Graduate School of Informatics Professor,TANAKA TOSHIYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Mon.5	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

In the analysis of stochastic discrete event systems, the theoretical results on Markov chains are useful mathematical tools. This course covers the fundamental results of Markov chains and their applications to ranking/rating methods and to the analysis methods of basic queuing models.

[Course objectives]

This course aims to deepen the understanding of the fundamental results of Markov chains and their applications.

[Course schedule and contents]

Outline of this course and review of fundamental notions,1?2times,The contents of this course are outlined. Furthermore, basic notions, such as random variables, probability distributions and generating function methods, are explained.
Discrete-time Markov chains,3?4times,The discrete-time Markov chain is introduced. Topics include the basic notions of the Markov chain, such as irreducibility, period, and recurrence, as well as the condition for the existence of its stationary and limiting distributions.
Markov methods for ranking/rating,2～3times,Markov methods for ranking/rating are lectured, focusing on the group of web pages.
Continuous-time Markov chains,3～4times,The Poisson process and continuous-time Markov chain are introduced. Furthermore, the properties of a birth-and-death process (a special case of the continuous-time Markov chain) are explained, together with the derivation of its stationary distribution.
Exponential-type queueing models,2～3times,Exponential-type queueing models (which are reduced to birth-and-death processes) are lectured, focusing on the derivation of their performance measures, such as the stationary queue length distribution and the waiting time distribution.

[Course requirements]

Background knowledge on probability and statistics is helpful to learn this course but it is not prerequisite.

[Evaluation methods and policy]

Based on the scores of the term examination.

[Textbooks]

Handouts are provided.

Continue to 確率離散事象論(2)↓↓↓

確率離散事象論(2)

[References, etc.]

（Reference books）

P. Bremaud, Markov Chains: Gibbs Fields, Monte Carlo Simulation, and Queues, Springer, 1999. isbn{}{ 9780387985091}

L. Kleinrock, Queueing Systems Vol.1, John Wiley and Sons, 1975. isbn{}{9780471491101}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39099 LJ11		
Course title (and course title in English)	ソフトウェア工学（計算機） Software Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Takayuki ITO Institute for Information Management and Communication Professor,ATSUMI NORITOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Mon.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Introduction,1time,
Software Requirements Engineering,2times,
Software Design Techniques,2times,
Software Process,1time,
Software Quality Management,1time,
Business Model Innovation,1time,
Project Management,1time,
Software Modules,1time,
Softwre Tests,1time,
Formal Methods,1time,
Software Metrics,1time,
Software Maintenance and Evolution,1time,
Summary and Assessment,1time,

[Course requirements]

None

[Evaluation methods and policy]

Continue to ソフトウェア工学（計算機）(2)↓↓↓

ソフトウェア工学（計算機）(2)

[Textbooks]

[References, etc.]

（Reference books）

Ian Sommerville: quotSoftware Engineering 10th Editionquot, Pearson, 2016. isbn{}{9780133943030}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39103 LJ11		
Course title (and course title in English)	オペレーティングシステム（計算機） Operating Systems	Instructor's name, job title, and department of affiliation	Academic Center for Computing and Media Studies Professor,SHUDO KAZUYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,9times,
,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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29104 LJ10　U-ENG29 29104 LJ11		
Course title (and course title in English)	言語とオートマトン Formal Languages and Automata	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,YAMAMOTO AKIHIRO

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Wed.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

We start with regular expressions and finite automata, then go to context-free grammars and pushdown automata. We learn why studying automata theory is important in computer science especially design and analysis of algorithms.

[Course objectives]

[Course schedule and contents]

,1time,
Finite automata,5times,Description of finite automata, minimization and regular expressions.
Context-free grammars,4times,Push-down automata, context-free grammars and their equivalency.
Turing machines and related issues,3times,Turing machine, its definition and basic properties.
Hierarchy of languages,2times,Summary of language classes. Discussions to check the achievements of students

[Course requirements]

None

[Evaluation methods and policy]

Will be specified in the lectures.

[Textbooks]

Iwama, Automata, languages and theory of computation, Corona-sha, 2003 isbn{}{433901821X}.

Continue to 言語とオートマトン(2)↓↓↓

言語とオートマトン(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 49108 SJ12　U-ENG29 49108 SJ13　U-ENG29 49108 SJ11		
Course title (and course title in English)	情報と職業 Information and Business	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TANIGUCHI TADAHIRO Graduate School of Informatics Associate Professor,Drazen Brscic

Target year	4th year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Fri.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,7times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

Continue to 情報と職業(2)↓↓↓

情報と職業(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
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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39109 LJ11				
Course title (and course title in English)	コンピュータネットワーク Computer Networks		Instructor's name, job title, and department of affiliation	Academic Center for Computing and Media Studies Professor,OKABE YASUO	
Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester
Days and periods	Tue.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Learn about basic technologies on computer networks, which are the indispensable basis of the ubiquitous network society. The idea of the Internet, basic concepts of the Internet architecture and the protocols are lectured. Visions for the future are also presented.

[Course objectives]

Students will understand the principles of computer networks and will be able to explain how they work. Students will be able to create simple programs to communicate over the Internet.

[Course schedule and contents]

Introduction, 1 times,
- Service and protocols
- The reference models

Direct Links, 3 times,
- Principles
- Media Access Control
- Datalink layer technologies

Internetworking, 3 times,
- Datagram and virtual circuit
- Internet Protocol (IP)
- Routing

End-to-End Protocols, 3 times,
- UDP (User Datagram Protocol)
- TCP (Transmission Control Protocol)
- Network Resource Allocation and Congestion Control

Network Security, 1 time,
- Trust and threats
- Cryptography and authentication

Applications, 3 times,
- Application-level protocols

Continue to コンピュータネットワーク(2)↓↓↓

コンピュータネットワーク(2)

* Electronic mail
* Web (World Wide Web)
- DNS (Domain Name System)

Feedback, 1 time

[Course requirements]

None

[Evaluation methods and policy]

Grading is based on the semester-end exam, and partially on reports and the attendance.

[Textbooks]

Larry Peterson, Bruce Davie 『Computer Networks: A Systems Approach, 6th edition』 (Elsevier, 2019) (https://book.systemsapproach.org/)
The textbook is published under the Creative Commons (CC BY 4.0) license, which permits secondary use in addition to modification, with the main condition that the original author's credit (name, title of work, etc.) be displayed.

[References, etc.]

(Reference books)

Norio Shiratori (ed.) 『Information Network』 (Kyoritsu, 2011) ISBN:9784320123038 ((in Japanese))
Katsuo Ikeda (ed.) 『Computer networks』 (Ohmsha, 2001) ISBN:4274132226 ((in Japanese))
Olivier Bonaventure 『Computer Networking : Principles, Protocols and Practice, 1st edition』 (Saylor Foundation, 2011) (Free PDF 282 pages at the author's site http://cnp3book.info.ucl.ac.be/1st/html/)

[Study outside of class (preparation and review)]

Students are required to take the Kyoto University Information Security e-learning course.
http://www.iimc.kyoto-u.ac.jp/en/services/ismo/e-Learning/

(Other information (office hours, etc.))

Questions are welcome at any time via LMS or e-mail.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 19115 LJ11　U-ENG29 19115 LJ10				
Course title (and course title in English)	アルゴリズムとデータ構造入門 Introduction to Algorithms and Data Structures	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Takayuki ITO		
Target year	1st year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Mon.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Algorithms and data structures are two fundamental components of computer programs. This course gives their basic concepts, design principles, techniques, and other important concepts in computer science.

[Course objectives]

The goals of the course is to understand: - mathematical models of computers and concepts of computational complexity, - basic algorithms and data structures, - design principles of algorithms, such as divide-and-conquer method and dynamic programming, - classes of hard problems and solutions to them, and - basic ideas of graph algorithms, approximation algorithms, and online algorithms.

[Course schedule and contents]

Introduction,1time,Overview
algorithms,2.5times,sorting, search, ...
data structures,2.5times,list, stack, queue, binary search, heap, hash, ...
algorithm design,2times,divide-and conquer, dynamic programming, ...
graph algorithms,2times,- Trees and graphs - depth-/breadth-first search - shortest path algorithms - maximum-flow algorithms
computational complexity,3times,P, NP, NP-complete, NP-hard, ...
advanced topics,1time,approximation and online algorithms
final exam,1time,

[Course requirements]

None

[Evaluation methods and policy]

Mid-term and final examinations

[Textbooks]

will be specified in the lectures

[References, etc.]

（Reference books）
will be specified in the lectures

Continue to アルゴリズムとデータ構造入門(2)↓↓↓

アルゴリズムとデータ構造入門(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39116 LJ12		
Course title (and course title in English)	人工知能 Artificial Intelligence	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KANDA TAKAYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture introduces basic technologies of artificial intelligence. Topics will be selected from search, machine learning, and real-world agent.

[Course objectives]

Learning the concept of artificial intelligence and the basic models and algorithms of search, machine learning, and real-world agent.

[Course schedule and contents]

Introduction,1time,Introducing the history of artificial intelligence researches.
Search,3-4times,Introducing breadth-first search, depth-first search, heuristic search, AND/OR-graph search, adversarial search, constraint satisfaction, etc. Applications of search techniques such as computer chess, Sudoku, are also introduced.
Machine Learning,7-8times,Introducing decision tree learning, perceptron, SVM, genetic algorithm, reinforcement learning, deep learning, etc. Applications of machine learning techniques such as data mining are also introduced.
Real-world agent,3-4times,Introducing AI techniques for quotuncertainquot situation, including basic perception and robotics, and probabilistic reasoning over time. Applications of AI for robotics are also introduced.
Achievement level check,1time,Checking the achievement level

[Course requirements]

None

[Evaluation methods and policy]

By reports and a final examination.

[Textbooks]

Materials will be distributed.

[References, etc.]

（Reference books）

S. Russell and P. Norvig, Artificial Intelligence A Modern Approach (3rd.ed.), Prentice Hall, 2010 isbn{}{

Continue to 人工知能(2)↓↓↓

人工知能(2)

9780136042594}.

[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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 49118 LJ55　U-ENG29 49118 LJ10		
Course title (and course title in English)	数理解析 Analysis in Mathematical Sciences	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,FUJIWARA HIROSHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Thu.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,5times,
,3times,
,2times,
,1time,
,1time,
,1time,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 数理解析(2)↓↓↓

数理解析(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 49119 LJ66　U-ENG29 49119 LJ13		
Course title (and course title in English)	生命情報学 Introduction to Computational Systems Bioinformatics	Instructor's name, job title, and department of affiliation	Institute for Chemical Research Professor,AKUTSU TATSUYA Graduate School of Informatics Professor,KUMADA TAKATSUNE

Target year	4th year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

この講義では生命情報解析および生命システム理解のための情報技術および数理モデルについて説明する．特に，DNA配列データ，タンパク質立体構造，生体内ネットワーク，神経回路網，進化の解析などを中心に様々な情報技術や数理モデルがどのように適用されるのかについて説明する．生命情報学（バイオインフォマティクス）や脳科学に関する基礎知識を身につけるとともに，情報学がどのように生物学や脳科学に応用されるかについて理解することを目的とする．

[Course objectives]

生命や生体の諸現象を情報学の観点から理解できるようになる．DNAや脳といった生命現象のフロンティアの知識を，生物学や脳科学とは違った観点から学ぶことができる．

[Course schedule and contents]

脳の神経情報処理（熊田）,1回,神経細胞の生理学的説明，脳の解剖学的・機能的説明を行う．また，主要な脳機能計測法についても説明する．
視覚情報処理（熊田）,2回,人間の物体認識と注意の機能を取り上げ，脳内情報の処理の観点から説明するとともに，それらが障害された場合に生じる病態から，脳内情報処理のメカニズムを説明する．
注意機能（熊田）,2回,脳の情報処理を注意という観点から解説する．脳のネットワークモデルなどを中心として, 脳内で行われている情報の選択のメカニズムを説明する．
認知機能（熊田）,2回,脳の前頭葉機能，特に，行動の選択や意図，価値などの脳内表現について説明する．また，インタフェース場面などでの人間行動と脳機能の関係についても説明する．
生命情報学概観（阿久津）,1回,分子生物学の基礎事項を説明するとともに，生命情報学について概観し，主要研究トピックについて説明する．
配列解析基礎（阿久津）,1回,DNA配列やアミノ酸配列の類似性を調べるための配列アラインメント問題，および，それを解く動的計画法アルゴリズムについて説明する．
進化系統樹推定法（阿久津）,2回,生物の進化の過程を表現するグラフ構造（進化系統樹）を配列データから推定するための最適化手法や統計的手法について説明する．
隠れマルコフモデル（阿久津）,1回,時系列データの変動を記述するモデルのひとつ，隠れマルコフモデルの概要およびアルゴリズム，さらに，そのDNA配列およびアミノ酸配列解析への適用法について説明する．
タンパク質構造解析（阿久津）,1回,タンパク質の立体構造の類似性を判別する手法，および，アミノ酸配列データからタンパク質立体構造を推定するための最適化手法について説明する．
スケールフリーネットワーク（阿久津）,1回,多くの生体内ネットワークが持つグラフ論的特徴（スケールフリー性など），および，その生成モデルについて説明する．
講義、レポートのフィードバック（熊田・阿久津）,1回,期間を定めて，講評や試験結果についての

Continue to 生命情報学(2)↓↓↓

生命情報学(2)

学生からの質問を受け付け，メール等で回答する．

[Course requirements]

プログラムを作った経験があることが望ましいが必須ではない．生物学や脳科学に関して必要な知識は講義中で説明する．

[Evaluation methods and policy]

レポート課題２回（２５点＋２５点）と期末試験の成績（５０点）の合計点で評価し，６０点以上を合格とする．
なお，レポートの提出状況の問い合わせには応じないので，各自が自分自身で把握しておくこと．

[Textbooks]

特に定めない．

[References, etc.]

（Reference books）
講義中に適宜，紹介する．阿久津担当分は以下が参考となる．
阿久津達也　著：バイオインフォマティクスの数理とアルゴリズム，共立出版 (2007) isbn{}{ 9784320121782}.

[Study outside of class (preparation and review)]

必要に応じて，予習・復習をすべき事項を指示する.

（Other information (office hours, etc.)）

当該年度の授業回数などに応じて一部省略，追加，順番の変更がありうる.
オフィスアワー：メールによる事前予約があれば随時

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39122 LJ12　U-ENG29 39122 LJ10				
Course title (and course title in English)	パターン認識と機械学習 Pattern Recognition		Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KAWAHARA TATSUYA	
Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course provides foundations of modeling and systems, which extract useful information for classification and prediction from real-world data. It covers a variety of machine learning techniques oriented for pattern recognition.

[Course objectives]

to master basic approaches and major techniques of machine learning.
to be able to design a system for pattern classification and recognition.

[Course schedule and contents]

1. Introduction to pattern recognition
2. Discriminant function and machine capacity
3. Discriminant function based on Gaussian distribution
4. Clustering and Gaussian mixture model
5. DP matching and HMM (classification of sequential patterns)
6. Maximum likelihood estimation and Bayes learning
7. Naive Bayes classifier and logistic regression model
8. Perceptron and Support Vector Machines
9. Neural network
10. Statistical feature extraction
11. Deep learning
12. Autoencoder and VAE
13. RNN and Transformer
14. Pattern recognition systems and non-supervised learning
15. Examination and Feedback

[Course requirements]

None

[Evaluation methods and policy]

The grading is based on the examination following the course, and some exercises provided in the course.

Continue to パターン認識と機械学習(2)↓↓↓

パターン認識と機械学習(2)

[Textbooks]

Lecture slides are provided via LMS CMS.

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Excersize included in lecture slides

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39123 LJ10　U-ENG29 39123 LJ57		
Course title (and course title in English)	非線形動力学（数理） Nonliner Dynamics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,AOYAGI TOSHIO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Fri.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 非線形動力学（数理）(2)↓↓↓

非線形動力学（数理）(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29125 EJ10　U-ENG29 29125 EJ55		
Course title (and course title in English)	数理工学実験 Applied Mathematics and Physics Laboratory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,KAWAGOE DAISUKE Graduate School of Informatics Assistant Professor,YOSHIWATARI KANAE Graduate School of Informatics Assistant Professor,TSUTSU HIROKI Graduate School of Informatics Assistant Professor,HARADA KENJI

Target year	2nd year students or above	Number of credits	4	Year/semesters	2026/Second semester
Days and periods	Mon.3,4,Tue.3,4	Class style	Experiment (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Applied Mathematics and Physics is a scientific discipline that gives theoretical foundations to understand and explain the behavior of systems and physical phenomena around us, as well as give us means to solve various problems. This experiment class is a chance to see in action the basic principles of mathematical modeling behind engineering that have been learned in elementary mathematics and physics courses. In addition, students will work on developing their programming skills and learn how to produce scientific reports in the LaTeX system.

[Course objectives]

・Understand basic algorithms and develop skills to implement them in a programming language, as well as use experimental results to analyze, understand, and conjecture about certain phenomena.
・Become familiar on using the LaTeX writing system, and producing scientific reports.

[Course schedule and contents]

Seven contents are provided, and each of them takes four days. Instructors may exchange the order of the contents.

Day 1-2　: Class guidance and instructions on writing reports
・Guidance on the course of the classes, as well as using the BYOD class system
・General instructions on writing scientific reports
・Producing plots of a set of data, including illustrations using the LaTeX system, etc.
Day 3-6: Numerical linear algebra
Day 7-10: Least squares method
Day 11-14: Ordinary differential equations
Day 15-18: Monte Carlo simulation
Day 19-22: Finding function roots; Continuous optimization
Day 23-26: Combinatorial optimization
Day 27-30: Image generation by neural networks (VAE and GAN, etc)

Continue to 数理工学実験(2)↓↓↓

数理工学実験(2)

[Course requirements]

Acquired credits for all Basic Subjects offered by the Applied Mathematics and Physics Course.

[Evaluation methods and policy]

The evaluation will be based on a report for each class topic. Submitting reports for all topics is necessary to get credit for the class (note: it is not guaranteed that credit will be earned if all reports are submitted).
In addition, tardiness, absence from class, and resubmitting a report will reduce the grade.

[Textbooks]

An experiment manual prepared by the instructors will be distributed in class.

[References, etc.]

（Reference books）

Supplemental materials will be introduced if deemed necessary.

[Study outside of class (preparation and review)]

Pre-class preparation by reading the provided experiment manual, class notes, and other reference materials is highly recommended.

（Other information (office hours, etc.)）

This class is in BYOD (Bring Your Own Device) style, and it is mandatory to bring your own computer for the class.

In addition, it is necessary to prepare the necessary environment and software for conducting the class:
・Prepare to use the LaTeX system to produce reports
・Prepare an environment of programming language in advance. Any programming language is not specified, but check if the language is suitable for scientific computation.

For the details, check LMS.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29127 LJ11				
Course title (and course title in English)	計算機の構成 Computer organization		Instructor's name, job title, and department of affiliation	大阪大学　教授 FUJII KEISUKE	
Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Wed.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course presents an overview study of the basic organization of computers and their operation principles, instructions of computers, computer arithmetic, how to design simple computers, and overview of memory hierarchy and I/O of computers.

[Course objectives]

1. Students will understand and be able to explain basic organization of a computer and its operation principles.
2. Students will understand and be to explain instructions of computers.
3. Students will understand and be able to explain computer arithmetic.
4. Students will understand and be able to explain design methods of simple processors.
5. Students will understand and be able to explain overview of memory hierarchy and I/O of computers.

[Course schedule and contents]

Basic computer organization and its operation principles (2 classes)
Students will learn about basic computer organization and its operation principles, as well as performance evaluations.

Instructions of computers (5 classes)
Students learn about instructions of computers.

Computer arithmetic (3 classes)
Students learn about computer arithmetic and floating-point arithmetic.

Design of simple processors (3 classes)
Students learn design methods of simple processors.

Overview of memory hierarchy and I/O of computers. (1 class)
Students learn about an overview of memory hierarchy and I/O of computers.

Term-end examination (1 class)

Feedback (1 class)
Review, including of the problems on the final examination, etc.

Continue to 計算機の構成(2)↓↓↓

計算機の構成(2)

[Course requirements]

Having knowledge on logic circuits is preferable.

[Evaluation methods and policy]

Evaluation is performed regarding each element of this course's end goals, namely, the term-end examination (approximately 90%) and exercises (approximately 10%). If an understanding is shown of 80% or higher on the term-end exam, then the student will pass the course.

[Textbooks]

David A. Patterson and John L. Hennessy, Translated in Japanese by M. Narita 『Computer Organization and Design - The Hardware/Software Interface - 6th ed. No. 1』 （Nikkei BP）ISBN:97848296070091

[References, etc.]

（Reference books）

David A. Patterson, John L. Hennessy 『Computer Organization and Design, The Hardware/Software Interface, MIPS Ed. Sixth Ed.』 （Morgan Kaufmann, 2021）ISBN:9780128201091

（Related URLs）

http://www.lab3.kuis.kyoto-u.ac.jp/~ntakagi/co.html

[Study outside of class (preparation and review)]

Students are to read assigned textbook portions to prepare for each class.
Students are to solve the problem exercises assigned during each class and to submit each week's problems before the next class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39128 LJ11		
Course title (and course title in English)	プログラミング言語処理系 Implementation of Programming Languages	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,SUENAGA KOUHEI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Mon.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This class will be given in Japanese. For the detail of the class, see the Japanese version.

[Course objectives]

[Course schedule and contents]

Introduction,1time,
Programming language used in the class,1time,
Interpreters,5times,
Midterm exam,1time,
Backend of compilers,3times,
Lexers and parsers,3times,
Advanced topics,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to プログラミング言語処理系(2)↓↓↓

プログラミング言語処理系(2)

[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.

[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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29129 LJ10　U-ENG29 29129 LJ11		
Course title (and course title in English)	情報符号理論 Information and Coding Theory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TANIGUCHI TADAHIRO

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Instructed during class

[References, etc.]

（Reference books）

Introduced during class

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29130 LJ11 U-ENG29 29130 LJ72		
Course title (and course title in English)	電気電子回路入門 Introduction to Electric and Electronic Circuit Theory	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,SHIMODA HIROSHI Graduate School of Energy Science Professor,IWAO KAWAYAMA

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester
Days and periods	Wed.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

It has long been introducing computers to various situations of our daily lives and these computers can work based on electric signals. If you look around society, electricity is used in various contexts such as lighting, air conditioning, motive power and control, and its fundamental principle is electric or electronic circuit. The purpose of this subject is explanation of basic knowledge of electric and electronic circuit, to understand the fundamental principles and to get the ability to analyze simple circuits.

[Course objectives]

To understand;
- basic way of thinking and principles of electric circuit,
- analysis method of simple electric circuits consisting of power supplies and passive components,
- principles of active components such as diodes and transistors,
- principles of amplifier circuits and oscillation circuits employing active components, and
- basic principle of digital electronic circuits.

[Course schedule and contents]

1. Direct current circuit (1.5 times)
- Ohm's law
- Kirchhoff's law
- Voltage source and current source
- Thevenin's theorem and Norton's theorem

2. Alternating current circuit (3.5 times)
- Sinusoidal alternating current
- Inductance and capacitance
- Vector display of sinusoidal alternating current
- Resonance circuit
- Bridge circuit

3. Basics of semiconductor devices (2 times)
- Diode
- Bipolar transistor
- Field effect transistor

4. Analog electronic circuit (4 times)
- Basic concept of electronic circuit
- Amplification circuit

Continue to 電気電子回路入門(2)↓↓↓

電気電子回路入門(2)

・Oscillation circuit
・Operational amplifier circuit
5. Digital electronic circuit　(3 times)
・Semiconductor switch element
・Semiconductor logic circuit
・Digital input/output interface circuit
6. Feedback (1 time)
・Q&A

[Course requirements]

・To know high school level knowledge of electric circuit, and
・To understand simple differential and integral calculus.

[Evaluation methods and policy]

The achievement will be evaluated through submission of exercises given in the class (20%), submission of report assignments (20%) and the result of final examination(60%).

[Textbooks]

Susumu Sugiyama, Katsuhiko Tanaka, Satoshi Konichi 『Electric and Electronic Circuit - Analog and Digital Circuit - (In Japanese)』（CORONA PUBLISHING CO.,LTD.）ISBN:9784339045130

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Preparation, review and assignment will be given by each lecturer in the class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29131 LJ10		
Course title (and course title in English)	計算機科学のための数学演習 Mathematics in Practice for Computer Science	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,IKEBUCHI MIRAI Graduate School of Informatics Assistant Professor,ATARASHI KYOHEI Graduate School of Informatics Associate Professor,SUENAGA KOUHEI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Thu.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

Continue to 計算機科学のための数学演習(2)↓↓↓

計算機科学のための数学演習(2)

[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.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39132 EJ72　U-ENG29 39132 EJ10		
Course title (and course title in English)	システム工学実験（数理） System Analysis Laboratory	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,KOIKE HAJIME Graduate School of Informatics Assistant Professor,TOMITA TAKUMA

Target year	3rd year students or above	Number of credits	4	Year/semesters	2026/First semester

Days and periods	Thu.4,5,Fri.4,5	Class style	Experiment (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Systems engineering consists of three factors: (1) modeling, (2) analysis, and (3) control. Our course aims at making students have a solid grasp of systems engineering through applications of their knowledge to the two real systems: Flexible-Link Manipulator and Inverted Pendulum. Students will master control and learning theoretic methods through computer simulations and pilot experiments. Students will be divided into two groups in the first guidance class to study all two different systems in turn.

[Course objectives]

To understand the following theoretical knowledge through the control experiment of the real systems:
-- Physics modeling based on the first principle
-- Parameter identification based on statistical learning and optimization
-- System stabilization and reinforcement learning

Students will learn how to collect and use data according to control purposes and acquire mathematical and data science solutions to problems that may occur in real systems.

To precisely express one's own understanding of the experiments through presentations and reports.

[Course schedule and contents]

Guidance, one time, Introduction of topics and dividing students into two groups if necessary

Flexible-Link Manipulator, 13 times,
1. A recursive estimation of the frequency transfer function and parameter identification
2. Tracking step signals
3. Data-driven control and optimal control design
*The specialized software MATLAB and SIMULINK are used for the experiment.

Inverted Pendulum, 13 times,
1. Mathematical modeling of inverted pendulum and parameter identification
2. Designing a controller for a simulation model using reinforcement learning
3. Stabilizing an inverted pendulum using reinforcement learning
*The specialized softwares Python and SIMULINK are used.

Feedback, three times.

Continue to システム工学実験（数理）(2)↓↓↓

システム工学実験（数理）(2)

[Course requirements]

Students are supposed to have knowledge of Introduction to Systems Analysis (90070).

[Evaluation methods and policy]

Class participation and reports are mainly evaluated. Attitude, Creativeness, and Individual work and group work are also important during the evaluation process.

[Textbooks]

Each instructor will distribute his own text when necessary.

[References, etc.]

（Reference books）

Doyle, Francic and Tannenbaum 『Feedback Control Theory』 （Prentice Hall,1992）ISBN:0023300116
Ljung 『System Identification』 （Prentice Hall,1998）ISBN:0136566952
Richard S. Sutton and Andrew G. Barto 『Reinforcement Learning, second edition』 （Bradford Books,2018）ISBN:0262039249

（Related URLs）

(Students will be informed when necessary)

[Study outside of class (preparation and review)]

Students have to prepare for presentations and reports for each subject.

（Other information (office hours, etc.)）

It is strongly recommended that third-year students take the courses Linear Control Theory (90720) and Signals and Systems (90810) and fourth-year students take the course Modern Control Theory (90580).
Under the BYOD policy of Kyoto University, students have to bring their own device to participate in classes.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39133 LJ11		
Course title (and course title in English)	計算機アーキテクチャ Computer Architecture	Instructor's name, job title, and department of affiliation	Academic Center for Computing and Media Studies Professor,OKABE YASUO Academic Center for Computing and Media Studies Professor,IWASHITA TAKESHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Mon.1	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

We learn pipelined instruction execution, memory hierarchy and parallel processing mechanism in modern computers.

[Course objectives]

Understanding the following topics so that you explain them to other people.
1. Instruction Pipeline
2. Memory Hierarchy
3. Parallel Processors

[Course schedule and contents]

Instruction Pipeline (1), 1 time, Overview of pipelining
Instruction Pipeline (2), 1 time, Pipelined data-path and its control mechanism
Instruction Pipeline (3), 1 time, Data hazards, Control (branch) hazards and exceptions
Instruction Pipeline (4), 1 time, Instruction-level parallelism
Instruction Pipeline (5), 1 time, Real Stuff: Intel Core i7 6700 and ARM Cortex-A53, Instruction-Level Parallelism and Matrix Multiply
Memory Hierarchy (1), 1 time, Memory technology, Basics of Cache
Memory Hierarchy (2), 1 time, Dependable Memory Hierarchy, Virtual Machines
Memory Hierarchy (3), 1 time, Virtual Memory, a Common Framework for Memory Hierarchy, Cache Coherence
Memory Hierarchy (4), 1 time, RAID, Real Stuff: ARM Cortex-A8 and Intel Core i7 Memory Hierarchies, Cache Blocking and Matrix Multiply
Parallel Processors (1), 1 time, Overview, SIMD extension, Vector processors
Parallel Processors (2), 1 time, Multithreading, Shared Memory Multiprocessors
Parallel Processors (3), 1 time, GPU, Domain Specific Architectures
Parallel Processors (4), 1 time, Clusters, Multiprocessor Network Topologies
Parallel Processors (5), 1 time, Multiple Processors and Matrix Multiply
End-of-term Exam, 1 time,
Feedback, 1 time

Continue to 計算機アーキテクチャ(2)↓↓↓

計算機アーキテクチャ(2)

[Course requirements]

Though not a mandatory prerequisite, you are expected to having received the credit of "Computer Organization" for 2nd-year students.

[Evaluation methods and policy]

Your achievements in end-of-term exam and per-class exercises are evaluated with respect to the "Course Goals".

[Textbooks]

David A. Patterson, John L. Hennessy, Translated in Japanese by M. Narita 『Computer Organization and Design - The Hardware/Software Interface - 6th ed. No. 2』（Nikkei BP, 2021）ISBN:978-4-296-07010-7
David A. Patterson, John L. Hennessy, Translated in Japanese by M. Narita 『Computer Organization and Design - The Hardware/Software Interface - 6th ed. No. 1』（Nikkei BP, 2021）ISBN:978-4-296-07009-1（https://bookplus.nikkei.com/atcl/catalog/21/S70090/）
If you already have the previous edition of the textbooks (5th edition) or the original one (English version) listed in the reference, you do not have to prepare the 6th edition. The differences between the 5th and 6th editions will be supplemented in class.

[References, etc.]

（Reference books）

The book "Computer Configuration and Design MIPS Editoin 6th Edition Up" was used as a textbook in the previous year's "Computer Configuration. 『Computer Organization and Design MIPS Edition The Hardware/Software Interface 6th Edition』（Morgan Kaufmann, 2020）ISBN:9780128201091（https://www.elsevier.com/books/computer-organization-and-design-mips-edition/patterson/978-0-12-820109-1）
John L. Hennessy, David A. Patterson 『Computer Architecture A Quantitative Approach 6th Edition』（Elsevier, 2017）ISBN:9780128119051（https://shop.elsevier.com/books/computer-architecture/hennessy/978-0-12-811905-1）

[Study outside of class (preparation and review)]

Through the work on the exercise, review what you learned in each class.

（Other information (office hours, etc.)）

Questions through LMS or emails are welcome at any time.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39136 LJ10		
Course title (and course title in English)	統計的モデリング基礎 Foundations of Statistical Modeling	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KASHIMA HISASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course gives foundations of statistical data modeling methods to capture the uncertainty in target systems and to estimate the probability of future events for prediction and control.

[Course objectives]

The goal of this course is to learn how to choose and apply appropriate processing and modeling approaches to analyze various types of data.

[Course schedule and contents]

Basic ideas,1time,Basic ideas of statistical data analysis
,1time,
Regression models,1time,Linear regression model and estimation methods
Model estimation,2times,Model estimation frameworks including maximum likelihood estimation
Model selection,2times,Model selection frameworks including information criterion
Models for categorical data,2times,Predictive models for categorical data including logistic regression
Correlation and causation,2times,Difference between correlation and causation. Methods for estimating causality.
Bayesian estimation,2times,Statistical inference methods based on Bayesian statistics
Models for various data types,2times,Models for various data types including time series and texts

[Course requirements]

Basic knowledge of probability and statistics

[Evaluation methods and policy]

Mid-term and final examinations

[Textbooks]

None

Continue to 統計的モデリング基礎(2)↓↓↓

統計的モデリング基礎(2)

[References, etc.]

（Reference books）

They will be given in the lectures

（Related URLs）

(The course website will be given in the lectures)

[Study outside of class (preparation and review)]

Exercises on real data analysis.

（Other information (office hours, etc.)）

Office hours are available upon request. An appointment is needed by sending an email to kashima@i.kyoto-u.ac.jp

*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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29138 SJ11		
Course title (and course title in English)	計算機科学実験及演習１（計算機） Computer Science Laboratory and Exercise 1	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,DING, Shiyao Academic Center for Computing and Media Studies Assistant Professor,SUZUKI KENGO Academic Center for Computing and Media Studies Associate Professor,KONDO KAZUAKI Graduate School of Informatics Assistant Professor,ATARASHI KYOHEI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Wed.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,1time,
,1time,
,5times,
,5times,
,1time,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 計算機科学実験及演習１（計算機）(2)↓↓↓

計算機科学実験及演習１（計算機）(2)

[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.

[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

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39140 LJ12		
Course title (and course title in English)	メディア情報処理 Mutimedia Processing	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KAWAHARA TATSUYA Academic Center for Computing and Media Studies Professor,NAKAMURA YUUICHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Tue.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

This course provides an overview of technologies to handle, analyze, recognize and generate a variety of information media or pattern data such as speech, text, and image.

[Course objectives]

to master basic methods to deal with speech, text, and image, and also processing of their analysis, recognition and synthesis.

[Course schedule and contents]

Speech processing (Kawahara)
1. Information in speech and music
2. Speech analysis
3. Speech recognition and synthesis
4. Spoken dialogue systems

Natural language processing (Kawahara)
5. Natural language processing overview
6. Natural language processing based on neural networks
7. Large language models

Image Processing (Nakamura)
8. Composition and handling of image media
9. Color and perception
10. Signal Processing and Filtering (1): Basics of Filtering
11. Signal processing and filtering (2): feature extraction
12. Projection and reflection models and computer graphics
13. 3-D Perception and Computer Vision
14. Image recognition and neural networks

15. Examination and Feedback

Continue to メディア情報処理(2)↓↓↓

メディア情報処理(2)

[Course requirements]

None

[Evaluation methods and policy]

Based on the examination following the course

[Textbooks]

Lecture slides are provided via LMS CMS.

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Exercises included in lecture slides.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39141 SJ11		
Course title (and course title in English)	情報セキュリティ演習 Practice in Information Security	Instructor's name, job title, and department of affiliation	Academic Center for Computing and Media Studies Professor,OKABE YASUO

Target year	3rd year students or above	Number of credits	1	Year/semesters	2026/Intensive, First semester

Days and periods	Intensive	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

IDS (Intrusion Detection System), which detects attempts of unauthorized access, creates an enormous number of alarms, and it is difficult to analyze them manually. In this class, students learn the mechanism and role of IDS, and classify normal communication and attacks from IDS alarms by machine learning.

[Course objectives]

Students understand the role of IDS in network security.
Students understand the mechanism of signature-based IDS, and can explain advantages and disadvatages of the IDS. Students understand the mechanism of intrusion detection by machine learning, and can explain advantages and disadvantages of machine learning approach.

[Course schedule and contents]

Guidance,2times,Guidance on how this class is operated, and how to use computing facility for this class. Basic knowledge on the role of IDS in network security and how machine learning can help the intrusion detection.
Intrusion Detection by Signature-Based IDS,5times,Learn the mechanism of intrusion detection by signature-based IDS by studying open source signature-based IDS and attacks, such as correspondence between alarms issued from IDS and communications, and adding signatures to detect attacks.
Intrusion Detection by Machine Learning,7times,Learn the method of classifying normal and malicious traffic by machine learning algorithms and public dataset for benchmarking intrusion detection performance.
Presentation,1time,Based on the exercise, students presents their methods of intrusion detection using machine learning, and discuss it with other students and instructors.

[Course requirements]

Students should be able to have basic knowledge of Linux operations (editing files, etc). Students should be able to write simple programs by Python.

[Evaluation methods and policy]

The achievement of the tasks and the content of the presentations within the class.

Continue to 情報セキュリティ演習(2)↓↓↓

情報セキュリティ演習(2)

[Textbooks]

Hand out materials in class.

[References, etc.]

（Reference books）

Introduced during class

（Related URLs）

https://www.seccap.jp/basic/(This class is designated as an exercise course in the Basic SecCap program.)

[Study outside of class (preparation and review)]

Students should be able to have basic knowledge of Linux operations and Python.

（Other information (office hours, etc.)）

It is assumed that students will bring their own laptop computers. If you cannot bring your own, please contact the instructor in charge in advance.

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39142 LJ72　U-ENG29 39142 LJ10　U-ENG29 39142 LJ55		
Course title (and course title in English)	情報符号理論続論 Mathematical theory of information and communications	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,OBUCHI　TOMOYUKI Graduate School of Informatics Associate Professor,HONDA JUNYA

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Tue.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Lectures discuss information theory, a basic theory related to storing and transmission of information. While referring to contents of the course “Information and Coding Theory,” lectures take up topics such as entropy of continuous-valued random variables, Gaussian communication channels, rate-distortion theory, universal coding, etc. More advanced topics are also introduced, including network information theory and more.

[Course objectives]

Our goal is to gain an understanding that enables appropriate responses to questions and issues regarding examples introduced during lectures, topics set for written reports, etc.

[Course schedule and contents]

Introduction (1 class)
Confirmation of basic concepts, including information entropy, mutual information, source coding, channel coding, etc.

Information theory of continuous-valued random variables (3 classes)
When considering wireless communications and measurements, a theory is needed for random variables which take continuous values. The argument will proceed by introducing differential entropy for continuous random variables, and by taking up concrete examples from Gaussian communication channels, with discussion of the information transmission capabilities of such channels.

Rate-distortion theory (4 classes)
Toleration of a certain extent of information degradation enables more efficient data compression than when no degradation is permitted. Lectures focus on rate-distortion theory, the theory underpinning information compression with degradation toleration.

Mid-term review of learning achievement (1 class)
In order to check the level of students' learning achievement, we will ask them to write some reports and give them feedback through questions and explanations about the reports.

Information theory and statistics (4 classes)
Type theory is introduced so as to discuss universal information compression, large-deviations theory, hypothesis testing, and other applications.

Continue to 情報符号理論続論(2)↓↓↓

情報符号理論続論(2)

Network information theory (1 class)
Thanks to the development and spread of information and communications technologies, one-to-one information exchanges have been superseded by many-to-many information exchanges. There is a growing need, then, for discussions regarding these changes. Lectures will focus on fundamental network information theory, necessary for proceeding with such discussions.

Final review of learning achievement (1 class)
In order to check the level of students' learning achievement, we will ask them to solve problems/questions etc., related to the course, and further advice will be provided.

[Course requirements]

Prerequisites are knowledge of basic probability theory, and knowledge regarding the course “Information and Coding Theory.” Knowledge of statistics and Markov chains is also desirable.

[Evaluation methods and policy]

Grading is performed both on the basis of reports submitted when necessary during the term and the final exam.

[Textbooks]

T. M. Cover and J. A. Thomas 『Elements of Information Theory, 2nd ed.』（Wiley-Interscience）ISBN: 9780471241959（The e-book version can be accessed from within the university. A Japanese translation is also available from Kyoritsu Shuppan Publishing Co.）

[References, etc.]

（Reference books）
Other materials will be introduced in class as necessary.

[Study outside of class (preparation and review)]

Since a prerequisite of this class is the course ``Information and Coding Theory," an appropriate review of that course's contents is recommended prior to attendance. Assigned pages in the course textbook should be read before each lecture. A good way to review each class is to do the problems at the end of assigned chapters.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 29143 SJ11　U-ENG29 29143 SJ54　U-ENG29 29143 SJ10		
Course title (and course title in English)	プログラミング演習（数理:H31以降入学者） Exercise on Programming	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Assistant Professor,YAMAGUCHI YOSHIYUKI Graduate School of Informatics Assistant Professor,YOSHIWATARI KANAE Graduate School of Informatics Assistant Professor,KAWAGOE DAISUKE

Target year	2nd year students or above	Number of credits	4	Year/semesters	2026/First semester

Days and periods	Mon.3,4	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

Ｃ言語によるプログラミング実習を行う。手続き型言語を用いたプログラミングの基礎となる、データ型・演算子・配列・関数・条件分岐・繰り返し処理・多次元配列・ファイル操作等を、数理工学での基礎的なアルゴリズム実装を題材にして学ぶ。

[Course objectives]

数理工学の各分野において、コンピュータを有効活用するために必要なプログラミングの知識と技術を修得する。

[Course schedule and contents]

第1回　ガイダンスとレポートの書き方
　　レポートの適切な書法と各種ツールの活用について学ぶ。

第2回～第4回　手続き型言語入門・条件分岐と繰り返し構造と関数
　　基本的な文法、基本的なデータ型、基本的な関数とそれを用いたサンプルプログラミングの実行方法までを学び、プログラムの基本パーツである条件分岐や繰り返し構造、関数について、数値積分（台形公式）、1変数非線形方程式の解法（ニュートン法）などのアルゴリズム実装を題材にして学ぶ。

第5回～第9回　多次元配列
　　多次元配列の使い方を、基本的な行列演算、行列固有値問題の数値解法（べき乗法）、常微分方程式の数値解法、線形方程式の数値解法（ガウスの消去法）などのアルゴリズム実装を題材に学ぶ。

第10回～第14回　データ構造とファイル操作
　　構造体、ポインタ、動的メモリ確保などをソーティングや動的計画法などのアルゴリズム実装を題材に学ぶ。さらに、ファイルからのパラメータ入力や結果の出力やリダイレクトを組み合わせたコード作成についても学ぶ。

第15回　学習到達度の確認
　　プログラミング技術の到達度を確認する。

Continue to プログラミング演習（数理:H31以降入学者）(2)↓↓↓

プログラミング演習（数理:H31以降入学者）(2)

[Course requirements]

本演習はBYODで行うため、演習時には各自ノートPCを持参すること。

[Evaluation methods and policy]

各項目ごとに出されるレポートに基づき総合的に成績評価を行う。

[Textbooks]

Not used

[References, etc.]

（Reference books）
柴田望洋 『新・明解C言語 入門編　第2版 』（SBクリエイティブ）ISBN:978-4815609795

[Study outside of class (preparation and review)]

演習時間を有効的に活用するために、配布資料に基づく予習を行うこと。

（Other information (office hours, etc.)）

初回ガイダンスへの出席を必須とする。

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 19144 LJ10		
Course title (and course title in English)	最適化入門 Introduction to Optimization	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,YAMASHITA NOBUO

Target year	1st year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Thu.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

数理最適化は，データ解析や機械学習，制御，金融工学など様々な分野で使われる基礎的技術である． 数理最適化の基本的な方法のひとつである線形最適化法を中心に、数理最適化モデルの構築法や線形計画問題の解法について講述する。

本科目は「線形計画」の科目名を変更したものである。「線形計画」を既に習得済みの場合は、本科目を習得しても卒業に必要な単位とならない。

[Course objectives]

基本的な最適化モデルの考え方と定式化手法を習得するとともに，線形最適化問題の理論的性質と解法を理解する．

[Course schedule and contents]

数理最適化とは,1回,数理最適化の概要を紹介する．また，本授業で必要となる数学的事項，特に線形代数について復習する．
数理最適化モデル,4回,代表的な数理最適化モデルである線形最適化モデル、ネットワーク最適化モデル、非線形最適化モデル、組合せ最適化モデルを，経営や機械学習などにあらわれる簡単な例を用いて紹介する。
線形計画問題と基底解,2回,線形最適化問題を標準形に定式化し、基底解、実行可能基底解、最適基底解などの基本的な概念を説明する。
シンプレックス法(単体法),2回,線形最適化問題の古典的な解法であるシンプレックス法(単体法)の基本的な考え方とその具体的な計算法について述べる。さらに、実行可能解を見出すための二段階法を説明する。
双対性と感度分析,3回,線形最適化問題の重要な数学的性質である双対性について述べ、さらに問題を総合的に分析し意思決定を行う際に非常に有力な手段である感度分析の考え方を説明する。
発展的話題,2回,上回生科目である「最適化」につながる最適化の理論やアルゴリズムの考え方について述べる。
補足とまとめ,1回,講義内容のまとめ、補足および学習到達度の確認を行う。

Continue to 最適化入門(2)↓↓↓

最適化入門(2)

[Course requirements]

線形代数の基本的な事項(行列とベクトルの掛け算，2×2の行列の逆行列計算など)を履修していることが望ましい.

[Evaluation methods and policy]

期末試験の成績による.

[Textbooks]

福島雅夫，山下信雄 『数理計画入門 第3版 ―最適化の数理モデルとアルゴリズム―』（朝倉書店）
ISBN:9784254280067

[References, etc.]

（Reference books）
Introduced during class

[Study outside of class (preparation and review)]

授業前に，必要とする線形代数を復習すること.
また，授業で指示したスライドを一読すること.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39145 LJ10　U-ENG29 39145 LJ57				
Course title (and course title in English)	流体力学（数理） Fluid Dynamics		Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TAGUCHI Satoshi	
Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester
Days and periods	Tue.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

流体（液体・気体）や弾性体をはじめとする連続体の力学的挙動を理解するための入門として，流体力学の初歩について講義する。内容は流体力学に焦点をあてるが弾性体についても多くの事項は共通である。

[Course objectives]

流体の変形および運動を解析するための基礎的事項および数理的手法を習得すること。とくに流体方程式とその解析における微分積分学の役割を理解し，初等的な応用ができるようになること。完全流体、粘性流体の物理的および数理的特徴に関する理解を深めること

[Course schedule and contents]

第1回　連続体の概念および物質微分と加速度
連続体の概念について説明し，連続体を取り扱う方法の大枠を学ぶ。連続体の記述としてラグランジュ的記述とオイラー的記述について理解する。物質微分（ラグランジュ微分）を導入する。流体における速度と加速度について学ぶ。

第2回　質量保存則と輸送定理
質量保存則である連続の式を学ぶ。またレイノルズの輸送定理をもとに、連続の式の理解を深める。

第3回　応力と運動方程式
運動方程式を導く準備として応力を学ぶ。その物理的意味，表現法（応力ベクトル，応力テンソル）について学ぶ。

第4回　流体の運動方程式とエネルギー式
ニュートンの運動法則から応力テンソルを用いた流体の運動方程式を導く。また熱流を導入することでエネルギー方程式を定式化する。３つの保存則（連続の式，運動方程式，エネルギー方程式）を概観する。静力学の応用としてアルキメデスの原理を導く。

第5回　完全流体の動力学（１）
完全流体の基礎事項について学ぶ。オイラー方程式からベルヌーイの定理を導出する。ベルヌーイの定理の応用についても学ぶ。

第6回　完全流体の動力学（２）
完全流体の運動の基礎としてケルビンの循環定理をオイラー方程式にもとづいて示す。さらに渦管

Continue to 流体力学（数理）(2)↓↓↓

に関するヘルムホルツの渦定理を学び、完全流体の特徴を理解する。

第7回　流体の局所運動の表現
ナビエ・ストークス方程式を導く準備として、流体の局所変形を記述するために歪み速度テンソルを導入し，その意味について学ぶ。連続体の局所運動が局所変形と局所回転の合成であることを学ぶ。

第8回　ナビエ・ストークス方程式
ニュートン流体を定義する。ニュートン流体における歪み速度テンソルと応力テンソルの関係式について説明し，圧力の意味付けおよび粘性係数の定義と意味について説明し、粘性流体の支配方程式であるナビエ・ストークス方程式を導く。

第9回　ナビエ・ストークス方程式によって表される代表的な流れ（１）
ナビエ・ストークス方程式の厳密解としてクエット流やポワズイユ流といった基本的な流れを学ぶ。

第10回　ナビエ・ストークス方程式によって表される代表的な流れ（２）
代表的な非定常流の一つとしてストークス問題（レイリー問題）について学ぶ。この問題は空間1次元熱方程式の非定常境界値問題でもある。

第11回　レイノルズの相似則・ストークス近似とStokeslet
レイノルズの力学的相似則について学ぶ。粘性流体の相似パラメータであるレイノルズ数を学ぶ。レイノルズ数が小さいときに有効なストークス近似の基礎事項を学ぶ。

第12回 球を過ぎる流れとストークスの抵抗則
ストークス方程式をもとに代表的な軸対称流れである球を過ぎる流れを扱う。ストークスの抵抗則を流体方程式から導出することを学ぶ。

第13回　圧縮性の効果：音波
圧縮性流体の代表的現象として音波について学ぶ。圧縮性オイラー方程式から波動方程式を導き音波の基礎事項について学ぶ。

第14回　総括

講義の振り返りを行う。連続体理論の優れたところを概観するとともにその限界についても述べる。時間が許せば演習の解説も行う。

<<期末試験>>

第15回　フィードバック

履修者の理解度や当該年度の講義の進み具合を考慮して、一部の内容を変更する場合がある。

[Course requirements]

学部1、２回生で学修する程度の微分積分学、線形代数学、ベクトル解析、および力学の知識は仮定する。

Continue to 流体力学（数理）(3)↓↓↓

流体力学（数理）(3)

[Evaluation methods and policy]

到達目標に対する達成度を課題レポート（40%）と定期試験（60%）の結果に基づいて評価する。詳細は講義開始時に説明する。

[Textbooks]

Not used

[References, etc.]

（Reference books）

Introduced during class

[Study outside of class (preparation and review)]

予習・復習が必要であり、授業で導出した式やその内容は復習を通して各自で理解しておくことが求められる。また、レポート課題が指示された場合は、その内容をよく理解しておくこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39146 LJ12		
Course title (and course title in English)	ヒューマンコンピュータインタラクション Human Computer Interaction	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,YAMASHITA NAOMI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Wed.4	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

ヒューマンコンピュータインタラクション（HCI）とは、人と人工物（AI、システム、ロボットなど）がどのように関わり合い、影響を与え合うかを明らかにする学問分野である。HCIは、人工物を使いやすくするだけでなく、人々の生活や社会全体をより豊かにすることを目的としており、現代社会において重要な役割を果たしている。本授業では、HCIの基礎を学べるように、基本的な概念や応用例を解説する。

[Course objectives]

人と人工物、人と人のインタラクションを支援するシステムを設計・評価するための基礎的な知識を身に着ける。

[Course schedule and contents]

授業で扱う内容：
０．イントロダクション
１．人間と人工物のインタラクション
２．対話型システムのデザイン
３．入力インタフェース
４．ビジュアルインタフェース
５．人とコンピュータのコミュニケーション
６．CSCW
７．評価手法

[Course requirements]

None

[Evaluation methods and policy]

ミニットペーパー 10%、試験 90%

Continue to ヒューマンコンピュータインタラクション(2)↓↓↓

ヒューマンコンピュータインタラクション(2)

[Textbooks]

Not used

[References, etc.]

（Reference books）

Jenny Preece 『Human-Computer Interaction』（Addison-Wesley, 1994.）ISBN:978-0201627695
D. A. ノーマン 『誰のためのデザイン？』（新曜社、2015）ISBN:978-4788514348

[Study outside of class (preparation and review)]

オンラインでアクセス可能なデジタル教材を提供するので、これにアクセスして、予習・復習を行うこと。

（Other information (office hours, etc.)）

毎回の講義直後にミニットペーパー（数分で書ける）を提出してもらうので、各自ノートPCを持参すること。

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 19147 LJ10

Course title (and course title in English)	情報学概論 Introduction to Informatics	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,Takayuki ITO Graduate School of Informatics Professor,MORIMOTO JUN Graduate School of Informatics Associate Professor,TERAMAE JUNNOSUKE Graduate School of Informatics Associate Professor,HONDA JUNYA Graduate School of Informatics Professor,YAMASHITA NAOMI Graduate School of Informatics Professor,FUJII KEISUKE

Target year	1st year students or above	Number of credits	2	Year/semesters	2026/First semester

Days and periods	Tue.2	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

本科目では、情報学を構成する主要領域を俯瞰する。情報学科では高度情報化社会の基盤となる情報の本質を究明でき、数理的な思考によって高度なシステムの実際問題を解決できる人材を育てることを目標とする。本科目では、情報学を俯瞰するため、AI、HCI、機械学習、脳の数理、ロボット学習、量子計算について概説し、最後に、各コースから研究事例を紹介し最先端の情報学を概観する。

[Course objectives]

情報学を俯瞰し、AI、HCI、機械学習、脳の数理、ロボット学習、量子計算や研究事例についてその概要を理解する。

[Course schedule and contents]

1-3 人工知能概論　伊藤（計算機）
人工知能１：概論　人工知能の歴史や基本的なアルゴリズムについ概説する。
人工知能２：最近の発展　人工知能の最近の技術（言語モデルやその発展）について概説する。
人工知能３：マルチエージェントシステム　人工知能の分野の一つであるマルチエージェントシステムについて概説する。

4-5 HCI (Human-Computer Interaction)概論　山下（直）（計算機）
HCI１：概論　人と計算機の相互作用（HCI）の分野について、計算機が単なる道具から人と関わる存在へと変化してきた背景や基本的な考え方を概説する。
HCI２：最近の発展　高度化した計算機システムを背景に、人と計算機の協調や社会への広がりに関する研究動向を概説する。

6-7 脳とニューラルネットワークの数理科学 寺前（数理）
脳の数理１：生物の脳の情報処理を数理的に扱う理論神経科学の基礎を説明する。
脳の数理２：脳のダイナミクスの数理モデルとニューラルネットワークの基礎を説明する。

Continue to 情報学概論(2)↓↓↓

情報学概論(2)

8-9　機械学習概論 本多（数理）
機械学習１：人工知能の構成要素である機械学習の分類や概要について概説する。
機械学習２：機械学習のアルゴリズムやその各種AI技術との関連について概説する。

10-11 強化学習とロボット応用　森本（数理）
ロボット学習１：逐次意思決定の数理としての強化学習アルゴリズムの基礎を説明する。
ロボット学習２：物理AIとしての強化学習を用いたロボットの行動学習の基礎を説明する。

12 数理工学と社会　（数理）
数理工学の社会への適用例や研究例を様々な視点から紹介する。

13-14 量子計算　（計算機）
量子計算１：量子情報科学の基礎、量子計算の基礎について述べる。
量子計算２：量子アルゴリズム、量子コンピュータアーキテクチャ、量子誤り訂正について述べる。

15 先端研究紹介 各コース研究紹介。

[Course requirements]

None

[Evaluation methods and policy]

講義中の演習、レポートにもとづいて成績評価する。

[Textbooks]

適宜，資料を配布する。

[References, etc.]

（Reference books）
適宜，資料を配布する。

[Study outside of class (preparation and review)]

講義資料による予復習と演習課題。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 39148 LJ11		
Course title (and course title in English)	データベースと情報検索 Database and Information Retrieval	Instructor's name, job title, and department of affiliation	Institute for Liberal Arts and Sciences Professor,TAJIMA KEISHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2026/Second semester

Days and periods	Wed.3	Class style	Lecture (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

情報あるいはデータを検索するためのシステムは大きく二つに分けられる．一つは，必要なデータを自在に検索できるように，あらかじめデータを整理して格納しておくためのシステムであり，このようなシステムはデータベースシステムと呼ばれる．もう一つは，後から検索することを目的として作られたわけではないデータから，必要な情報に関連すると思われる部分を推定して取り出すためのシステムであり，情報検索システムと呼ばれる．本科目では，これらの双方について，その基礎となる理論を講述する．特に，前者については関係データベースの基礎理論についてを中心に，後者については，テキスト検索とWeb検索の基礎理論についてを中心に取り上げる．

[Course objectives]

データベースシステムについて以下の事項に関する知識を修得する．
・必要なデータを自在に取り出せるように格納するためのデータの整理の方法，特に，データを関係の形で整理する関係データモデルの考え方，および，関係データモデルにおけるデータの正規化の理論．
・関係の形で整理されたデータから必要な部分を指定するための様々な検索言語の表現能力．
・実用的な知識として，関係データ用の検索言語の標準規格であるSQLに関する基礎知識．
また，情報検索システムについて以下の事項に関する知識を修得する．
・テキストデータと検索キーワードの関連度を推定する手法．
・テキストデータから関連するトピックを推定する手法．
・Webに代表されるグラフ構造を持つデータから重要な頂点を推定する手法．

[Course schedule and contents]

１．計算機による情報・データ管理の歴史
２．ERデータモデル
３．関係データモデル
４．関係データモデルのための検索言語：関係代数
５．関係データモデルのための検索言語：SQL
６．関係データモデルのための検索言語：関係論理，Datalog
７．関係データモデルにおける関係の正規化
８．関係データモデル以外のデータ：DataCube，XML
９．情報検索における評価指標：適合率，再現率，F-measure，MRR，ERR，MAP，nDCG，順位相関係数
１０．古典的なテキスト検索モデル：Booleanモデル，ベクトル空間モデル，確率モデル
１１．テキストからのトピック抽出：Latent Semantic Indexing，word embedding
１２．情報検索のその他の話題：適合フィードバック，協調フィルタリング，データセットの作成

Continue to データベースと情報検索(2)↓↓↓

データベースと情報検索(2)

（κ係数，Davwid-Skene）
１３．グラフ分析：PageRank，HITS，Personalized-PageRank，SALSA
１４．グラフ分析：近接中心性，媒介中心性，Katz中心性，固有値中心性，α中心性，SimRank
１５．フィードバック

[Course requirements]

「数理論理学A」「グラフ理論」「人工知能2（旧科目では統計的モデリング基礎）」の各科目で扱う内容に関する基礎的な知識を有することが望ましい．

[Evaluation methods and policy]

到達目標に記載した知識を習得しているか，また，関係データベースシステムとSQLを実際に使用するために必要な知識を身につけているかを定期試験によって評価する．

[Textbooks]

Not used
教材は講義ノートを使用する．

[References, etc.]

（Reference books）
Introduced during class

[Study outside of class (preparation and review)]

講義ノートを用いて予習・復習を行うこと．また，授業中の演習問題や宿題を課すことがあるので，これらを用いて予習・復習を行うこと．

（Other information (office hours, etc.)）

Email: tajima@i.（京都大学のドメイン）

*Please visit KULASIS to find out about office hours.

[Essential courses]

Faculty of Engineering,Informatics and Mathematical Science

Course number	U-ENG29 49991 GJ11　U-ENG29 49991 GJ12　U-ENG29 49991 GJ10		
Course title (and course title in English)	特別研究１（計算機） Graduation Thesis 1	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,TANIGUCHI TADAHIRO

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[Overview and purpose of the course]

教員の指導のもと、情報学（計算機科学）に関連する研究課題を設定し、研究動向を把握したうえで、その課題解決力の向上を目指す。

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研究課題の設定、関連研究の調査、研究計画の立案等を通じて、研究活動に必要な力を向上させる。

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[Course requirements]

計算機科学コースの特別研究着手に必要な条件を満たしていること。

[Evaluation methods and policy]

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[Textbooks]

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[References, etc.]

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[Course requirements]

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[References, etc.]

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[Essential courses]

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Days and periods	Intensive	Class style	Seminar (Face-to-face course)	Language of instruction	Japanese

[Overview and purpose of the course]

教員の指導のもと、特別研究１で設定した課題について研究を行い、課題解決力を向上させるとともに、研究成果を特別研究報告書としてまとめ、特別研究試問会で発表する。

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研究の実施、特別研究報告書の作成、特別研究試問会での発表等を通じて、研究活動に必要な力を向上させる。

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