Course number	U-ENG29 22050 LJ55　U-ENG29 22050 LJ10		
Course title (and course title in English)	工業数学Ａ１ 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	2020/Second semester
Days and periods	Thu.2	Class style	Lecture	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

[Evaluation methods and policy]

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

[Textbooks]

Not used

Continue to 工業数学Ａ１(2)↓↓↓

Course number	U-ENG25 22055 LJ75　U-ENG25 22055 LJ55		
Course title (and course title in English)	工業数学Ｆ１（機材エネ原：学番奇数） Applied Mathematics for Engineering F1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NISHIKAWA MASAAKI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Introduction to complex analysis and some applications]

The objective is to explain the fundamentals of complex analysis, considering the application to engineering and science. The differential and integral calculus of complex functions, the relevant basic ideas, and the applications are introduced.

[Course objectives]

Understanding the basics of complex analysis and obtaining ability to practice it

[Course schedule and contents]

1. Definition of complex and complex plane
2-3. Differential of complex functions and Cauchy-Riemann relation
4-5. Concept and examples of regular functions
6. Line integral of complex functions
7-8. Cauchy's theorem and integral formula
9-10. Taylor and Laurent series
11-12. Singular points and residue theorem
13. Application to definite integral
14. Concept of conformal mapping, other topics
15. Feedback

Confirmation of learning achievement: Regular examination

[Course requirements]

Fundamentals of differential and integral calculus

[Evaluation methods and policy]

【Evaluation method】
Evaluation will be mainly based on regular examination.
In some cases, evaluation for homework (short reports: about four times) will be also considered.
(In these cases, the ratio of the evaluations for regular examination and homework is about 9:1.)
【Evaluation standard】
Evaluation will be based on class registration guideline.

Continue to 工業数学Ｆ１（機材エネ原：学番奇数）(2)↓↓↓

[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.

[Textbooks]

A. Fujimoto 『Outline of complex analysis (Fukuso-kaisekigaku Gaisetsu)』 （Baifukan）ISBN:978-4563005719（in Japanese, published in 1990.）

[References, etc.]

（**Reference books**）
To be referred to during the course

[Study outside of class (preparation and review)]

Homework (short reports) for the problems stated in the textbooks will be assigned.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 22055 LJ75　U-ENG25 22055 LJ55		
Course title (and course title in English)	工業数学Ｆ１（機材エネ原：学番偶数） Applied Mathematics for Engineering F1	Instructor's name, job title, and department of affiliation	Part-time Lecturer,

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Introduction to complex analysis and some applications

[Course objectives]

Understanding the basics of complex analysis and obtaining ability to practice it

[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]

Fundamentals of differential and integral calculus

[Evaluation methods and policy]

Regular examination and Reports

[Textbooks]

To be referred to during the course (Nishikawa), Not used (Murakami)

[References, etc.]

（**Reference books**）
To be referred to during the course

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

工業数学Ａ２(2)

[Textbooks]

quotIntroduction of Numerical Analysisquot (in Japanese) by T. Yamamoto, SAIENSU-SHA isbn{}{ 4781910386}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 32060 LJ54　U-ENG29 32060 LJ55　U-ENG29 32060 LJ10		
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,NAKAMURA YOSHIMASA Graduate School of Informatics Associate Professor,TSUJIMOTO SATOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

quotNumerical Analysisquot is prerequisite to this course. In this course matrix eigenvalue problem and singular value decomposition, iteration methods for nonlinear equations, interpolation methods by polynomials, and numerical integration methods are explained which are important especially in data science and information processing.　*There is a possibility to replace Course Topics. Detail will be announced at the first class.

[Course objectives]

Understanding both the theory and practical methods for applications through general-purpose softwares and/or programs by each student is a goal of this course.

[Course schedule and contents]

matrix eigenvalue problem,6times,computation of matrix eigenvalues and eigenvectors by the Jacobi method, Gershgorin theorem, the power method and the inverse iteration, the QR method and the divide amp conquer method with the Householder transformations for preprocessing, Sturm theorem
matrix singular value decomposition,1time,computation of matrix singular value decomposition
iterative methods for nonlinear equations,3times,the principle of contractive mapping and the Newton method both of one and multi variables, and convergence acceleration algorithms
interpolation methods ,2times,the Lagrange interpolation formula and the Hermitian interpolation formula by polynomials, and the spline functions
numerical integration methods,2times,Newton-Cotes numerical integration formula,and the Gauss type numerical integration formula
confirmation for student assessment,1time,confirmation for each student assessment
,1time,

[Course requirements]

Linear Algebra A, Linear Algebra B, Numerical Analysis

[Evaluation methods and policy]

mainly evaluated by examination score, but reports of exercises will be taken into account in a case.

Continue to 工業数学Ａ２(2)↓↓↓

未更新

Course number	U-ENG25 32065 LJ75　U-ENG25 32065 LJ55		
Course title (and course title in English)	工業数学Ｆ２（機：学番奇数） Applied Mathematics for Engineering F2	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,KANOU MANABU Graduate School of Informatics Professor,OOTSUKA TOSHIYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Fourier analysis and its application will be described. The major part consists of Fourier series, Fourier transform, and Laplace transform.

[Course objectives]

The goal is to understand the basics and applications of Fourier analysis.

[Course schedule and contents]

Preliminaries,1time,The goal and outline of this class are presented. Then, basic knowledge necessary to learn Fourier analysis is briefly reviewed.
Fourier series,1time,Fourier series expansion of periodic functions is described.
Complex Fourier series,1time,Complex Fourier series, its differential and integral, and spectrum are described.
Characteristics of Fourier series,1time,Characteristics of Fourier series are described.
Fourier transform,1time,In order to cope with aperiodic functions, Fourier transform is described.
Characteristics and applications of Fourier transform is explained together with the Parseval#039s equation and its applications.
Linear systems,1time,Linear systems is described. Solutions of linear differential equations are given by using Fourier series expansion. In addition, impulse responses and transfer functions of linear systems are explained.
Summary of the first half,1time,A summary of Fourier series and Fourier transform is provided, and an examination will be given.
Parseval#039s equality and its applications,1time,Parseval#039s equality, the WienerndashKhinchin theorem, and the relationship between impulse responses and cross-correlation functions in linear systems are described.
Introduction to partial differential equations,1time,Basic notions of partial differential equations are described.

Solutions of the wave equation and their physical interpretations,1time,The wave equation, one of important partial differential equations, is solved and physical interpretations of its solutions are discussed.
Fourier series for solving the wave equation,1time,Another expressions of solutions to the wave equation are derived in the form of Fourier series expansions.
Introduction to Laplace transform ,1time,Laplace transform and its characteristics are described aiming at solving ordinary differential equations.
Laplace transform for solving ordinary differential equations,1time,Ordinary differential equations are solved by applying Laplace transform and its inverse transform.
Discrete Fourier transform and fast Fourier transform ,1time,Discrete Fourier transform for analyzing sampled data is described.

Continue to 工業数学Ｆ２（機：学番奇数）(2)↓↓↓

工業数学Ｆ２（機：学番奇数）(2)

Evaluation of achievement,1time,The achievements are evaluated.

[Course requirements]

None

[Evaluation methods and policy]

The regular examination, assignments, and attitude in the class will be taken into account.

[Textbooks]

Shinichi Ohishi: Fourier Analysis, Iwanami-Shoten isbn{}{9784000077767}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 32065 LJ75　U-ENG25 32065 LJ55		
Course title (and course title in English)	工業数学Ｆ２（材） Applied Mathematics for Engineering F2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,ICHII TAKASHI Graduate School of Engineering Associate Professor,YUGE KORETAKA
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Fourier analysis, Laplace transform, Linear Algebra and their applications.

[Course objectives]

The final goal of this course is to understand basics of Fourier series expansion, Fourier transform, Laplace transform and Linear Algebra, and to learn to make full use of these mathematical tools in analyzing various physical phenomena and solving relevant differential equations. Particular emphasis is placed not on pursuing mathematical rigor but on developing skills to perceive different physical aspects of these tools and select the most appropriate one in practical problem solving.

[Course schedule and contents]

Fourier analysis, Laplace transform, Linear Algebra and their applications,15times,Complex numbers and complex analysis (1-2 weeks)\ -complex numbers and complex functions\ -complex integrals, residue theorem, and their applications\Delta function (1 week)\Fourier series expansion (2-3 weeks)\ -periodic functions and their Fourier series expansion\ -complex Fourier series expansion\ -applications of Fourier series\Fourier transform (2-3 weeks)\ -basics of Fourier transform\ -convolution and correlation function\ -applications of Fourier transform\ -linear response system\Laplace transform and its applications (2 weeks)\ -basics of Laplace transform\ -applications of Laplace transform to linear systems\Linear Algebra (3-4 weeks)\ - Vector space\ - Map and matrix\Applications of Fourier transform and Laplace transform (1-2 weeks)

[Course requirements]

Prerequisite subjects: complex numbers and basic calculus.

[Evaluation methods and policy]

The grading is made based on the regular examination.

[Textbooks]

Lecture notes are distributed at the class.

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 32065 LJ75　U-ENG25 32065 LJ55		
Course title (and course title in English)	工業数学Ｆ２（機：学番偶数） Applied Mathematics for Engineering F2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,SENAMI MASATO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 32065 LJ75　U-ENG25 32065 LJ55		
Course title (and course title in English)	工業数学Ｆ２（エネ原） Applied Mathematics for Engineering F2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,KISHIMOTO YASUAKI Graduate School of Energy Science Associate Professor,IMADERA KENJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.4	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

, 9 times,
, 2 times,
, 3 times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-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 Professor,YAGASAKI KAZUYUKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Fourier analysis originated in Fourier#039s 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 Laplace analysis closely related to it.

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

Calculus, Linear Algebra and Differential Eqautions

[Evaluation methods and policy]

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

Continue to 工業数学Ａ３(2)↓↓↓

未更新

Course number	U-ENG25 32075 LJ55		
Course title (and course title in English)	工業数学Ｆ３（機原） Applied Mathematics for Engineering F3	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,INOUE YASUHIRO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Introduction to special functions and mathematical methods for the physical sciences.

[Course objectives]

Understanding special functions and mathematical methods for the physical sciences, and developing problem solving skills.

[Course schedule and contents]

Orthogonal function,2times,
Orthogonal polynominals,2times,
Confluent hypergeometric function,1time,
Gamma and Beta functions,2times,
Bessel function,2times,
Generalized function,2times,
Green#039s function,1time,
Partial differential equations for physical sciences,2times,
Short Exam and Discussion,1time,

[Course requirements]

Theories of complex function and differential equation

[Evaluation methods and policy]

The course grade will be based on homework(30%) and quizzes(70%).

[Textbooks]

[References, etc.]

（**Reference books**）
Mathematical Methods for Physicists, George B. Arfken and Hans J. Weber (Academic Press) isbn{}{9780123846549}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

工業数学Ａ３(2)

[Textbooks]

S. Nakamura: Fourier analysis, Asakura shoten isbn{}{9784254115741}

[References, etc.]

（**Reference books**）
H.Fukawa: Mathematics of control and vibration, KORONA-SHA ibid{}{TW86010572}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 32080 LJ57　U-ENG25 32080 LJ52　U-ENG25 32080 LJ71		
Course title (and course title in English)	工業力学Ａ（機・宇） Engineering Mechanics A	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Associate Professor,NISHIHARA OSAMU Graduate School of Engineering Professor,HANAZAKI HIDESHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 32080 LJ57　U-ENG25 32080 LJ52　U-ENG25 32080 LJ71		
Course title (and course title in English)	工業力学Ａ（エネ） Engineering Mechanics A	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

, 4 times,
, 3 times,
, 2 times,
, 2 times,
, 2 times,
, 2 times,

[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.

工学倫理(2)

medicines and food productions. Associated with it, problems of their safety and ethics are arising, which should be addressed by our societies. In this class, the recent progress in biology-related techniques, and problems we have and will have in near future are described. (M. Shirakawa: Industrial Chemistry)
Patents and ethics (Part 1). (6/6) 1time. This course will teach the students about 1) patent systems which protect inventions and research results and 2) ethical issues in patents. The first class, in preparation for the next subject of patent ethics, introduces Japan’s patent system with comparisons to the patent systems in the world’s major countries and international framework. (M. Nakagawa: Electrical and Electronics Engineering)
Patents and ethics (Part 2). (6/13) 1time. Students, equipped with the basic knowledge of patent systems by the previous lecture, will get familiar with actual case studies on ethical and legal issues in patents. (M. Nakagawa: Electrical and Electronics Engineering)
Ethics required for advanced science. (6/27) 1time. Engineers and researchers are at the forefront of preventing harm caused by advanced chemistry. Think about social roles and ethics required by engineers and researchers through relationships between chemical substances and environmental problems, efforts to avoid hazards of nanomaterials. (K. Miura: Industrial Chemistry)
Ethics in press release. (7/4) 1 time. Press Release is an essential process for introducing the research to our society through various medias. In this lecture, issues related to Press Release in University are addressed and discussed. (K. Umeno: Informatics and Mathematical Science)
Failure accidents and inspection/maintenance (7/11) 1time. On the occasions of failure accidents of vehicles and plants, the appropriateness of inspection/maintenance of their structures is often questioned. Some actual failure accidents are reviewed to discuss the importance of inspection/maintenance together with the relation to engineering ethics.(S. Biwa: Engineering Science)
Ethics in nuclear engineering. (7/18) 1time. Discussion on engineering ethics in the TEPCO accident from view point of Tsunami evaluation by the Japanese government. (I. Takagi: Engineering Science)
Ethical issues on sound design. (7/25) 1 time. Every working things consuming energy emits acoustic sound. Even a small sound energy affect human as noise and may create annoyance and health problems. Sound problems of various things are introduced in the lecture. Ethical issues, which shall be considered during design and operation environment, will be discussed. (Y. Takano: Architecture)

[Course requirements]

None

[Evaluation methods and policy]

Class participation and reports.

[Textbooks]

Lecture materials will be distributed.

[References, etc.]

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

Continue to 工学倫理(3)↓↓↓

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,ATOMI HARUYUKI Graduate School of Informatics Professor,KANDA TAKAYUKI Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

Significance to learn engineering ethics. (4/11) 1time. As an introduction to this course, the meaning of engineering ethics and the significance to learning it are explained. Examples are shown in building engineering area on daily disastrous accidents and fire event. The significances of engineering ethics to those examples are discussed. (K. Harada: Architecture)
Geotechnical engineering and engineering ethics. (4/18) 1 time. Geotechnical Engineering is indispensable in discussing the underground public use, slope stability, geo-sequestration of byproduct for the energy generating. Introducing some examples of natural disasters and construction accidents, geotechnical engineering and engineering ethics will be discussed. (K. Kishida: Global Engineering)
Engineering ethics as an applied ethics. (4/25) 1 time. In this lecture, I will show the basic Idea of Engineering Ethics by comparing with the other fields of Applied Ethics. And show its unique character in the age of information technology. (M. Mizutani: Graduate School of Letters)
Ethical theories for engineering ethics. (5/2) 1 time. This lecture focus on various ideas in ethics (utilitarianism, deontology, virtue ethics, professional ethics etc.) which will be useful for thinking about particular ethical problems in engineering ethics. (T. Iseda: Graduate School of Letters)
Art-view concept for engineering. (5/9) 1time. Concept of "quality of life" is required for human related engineering. Some practical examples in medical-care and welfare fields will be introduced, and problem of the QOL-evaluation will be discussed from both function-optimizing view point and art view point. (N. Tomita: Engineering Science)
Ethics of biotechnology and stem cell research. (5/16) 1time. With the rapid development of genome editing technology and stem cell engineering, editing of the human genome that goes beyond generations has become possible, at least technically. In this lecture, I will introduce these latest technologies and think about ethical problems accompanying technological development. (G. Eiraku: Industrial Chemistry)
Research and engineering ethics. (5/23) 1time. It is said that He that will do no ill, must do nothing that belongs thereto. The sense of ethics necessary to whom conducts research and engineering work in society is discussed in terms of the importance of equitability and fair evaluation to anyone involved in each area of research or engineering. (H. Mikada: Global Engineering)
Ethics in biomedical engineering. (5/30) 1time. Recent dramatic progress in biology-related techniques, such as reproductive medicine, genome editing, and clone-animal techniques, is causing revolutions in the fields of

Continue to 工学倫理(2)↓↓↓

工学倫理(3)

[Study outside of class (preparation and review)]

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

（Other information (office hours, etc.)）

The class order is subject to change.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

Course number	U-ENG25 35148 LJ57　U-ENG25 35148 LJ75		
Course title (and course title in English)	職業指導 Vocational Guidance	Instructor's name, job title, and department of affiliation	Part-time Lecturer,INOUE　MAKI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

現代の日本は高学歴化が進み、学校教育において進学準備教育が重視される一方で、職業生活への移行にかかわる教育・訓練の機能は弱体化している。中等教育の目的の一つは、生徒の職業選択のための力量形成であり、さらに、専門高校では具体的な職業教育が行われてきた。本講義は、現代日本における職業教育の課題を理解するとともに、日本の専門高校における職業教育の実態を把握することを通じて、青年が生き方・働き方を主体的に選択できる教育とは如何なるものか、議論を深めることを目的とする。

[Course objectives]

・高校における職業教育の基本的な役割を理解する。
・国際比較の観点や労働市場との関係性をとおして、日本の高校職業教育の特徴を理解することができる。

[Course schedule and contents]

第1回　職業とは何か―その概念と種類
第2回　日本の学校における進路（職業）指導の起源と理論
第3回　学校と職業世界との接続(1)　日本的雇用システムと学校における進路指導の関係
第4回　学校と職業世界との接続(2)　日本の職業資格制度と学校教育
第5回　世界の職業教育―欧米における中等職業教育制度の特徴
第6回　技術・職業教育に関する国際的合意と日本の中等職業教育の位置
第7回　戦後の高校制度の性格と総合制―高校における職業教育の意義
第8回　専門高校における職業教育の実際(1)　進路指導のあり方と進路状況
第9回　専門高校における職業教育の実際(2)　職業資格・検定と専門教科の内容との関係
第10回　専門高校における職業教育の実際(3)　職場体験（インターンシップ）の実施と課題
第11回　日本の公的職業教育・訓練施設の種類と高校との接続関係
第12回　高等教育における職業教育―「専門職大学制度」の概要とこれから
第13回　日本におけるキャリア教育の提唱とその課題
第14回　日本の中等職業教育に関する課題の整理とその検討
第15回　総括・レポート試験

Continue to 職業指導(2)↓↓↓

Course number	U-ENG20 22501 SJ77		
Course title (and course title in English)	工学序論 Introduction to Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,OHTA HIROTO Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI

Target year	1st year students or above	Number of credits	1	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

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

Continue to 工学序論(2)↓↓↓

職業指導(2)

[Course requirements]

None

[Evaluation methods and policy]

レポート試験の成績（60％）　平常点評価（40％）
平常点評価には、授業への参加状況、授業内での積極的発言を含む。

[Textbooks]

Instructed during class

[References, etc.]

（**Reference books**）
堀内達夫・佐々木英一・伊藤一雄・佐藤史人編『日本と世界の職業教育』（法律文化社）ISBN: 978-4-589-03511-0
佐藤史人・伊藤一雄・佐々木英一・堀内達夫編『新時代のキャリア教育と職業指導--免許法改定に対応して』（法律文化社）ISBN:978-4-589-03953-8

[Study outside of class (preparation and review)]

復習：授業で配布した資料等をよく読んで、講義内容の理解を深めておくこと。

（Other information (office hours, etc.)）

開講時期：令和2年8月26日（水）～8月31日（月）の土日を除く4日間の集中講義
　　各日ともⅠ時限～Ⅳ時限まで（8月28日（金）のみⅡ～Ⅳ時限）

*Please visit KULASIS to find out about office hours.

工学序論(2)

[Textbooks]

Specify if necessary.

[References, etc.]

（**Reference books**）
Specify if necessary.

[Study outside of class (preparation and review)]

Specify if necessary.

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG23 23181 LJ73		
Course title (and course title in English)	ＧＬセミナーⅠ（企業調査研究） Global Leadership Seminar I	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,YOROZU KAZUAKI Graduate School of Engineering Senior Lecturer,KOMIYAMA YOSUKE
Target year	2nd year students or above	Number of credits	1
Year/semesters	2020/Intensive, year-round		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Not used

Continue to ＧＬセミナーⅠ（企業調査研究）(2)↓↓↓

未更新

Course number	U-ENG23 33184 PJ73		
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	Approved
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Intensive, year-round		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese and English		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Continue to 工学部国際インターンシップ１(2)↓↓↓

ＧＬセミナーⅠ（企業調査研究）**(2)**

[References, etc.]

（**Reference books**）

（**Related URLs**）

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

[Study outside of class (preparation and review)]

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

（**Other information (office hours, etc.)**）

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

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

工学部国際インターンシップ１ **(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

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

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG23 33182 LJ73		
Course title (and course title in English)	ＧＬセミナーＩＩ（課題解決演習） Global Leadership Seminar II	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,KANEKO KENTAROU Graduate School of Engineering Senior Lecturer,OHTA HIROTO
Target year	2nd year students or above	Number of credits	1
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

It is required to join the residential training. A report meeting is held and comprehensive evaluation concerning abilities in group discussion to extract or set up challenges and to propose solutions for achieving a goal is made through presentation of the proposal as well as a submitted report.

Continue to ＧＬセミナーＩＩ（課題解決演習）(2)↓↓↓

Course number	U-ENG27 37137 LE48　U-ENG27 37137 LE61		
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	Approved
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Intensive, year-round		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese and English		

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

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

[Evaluation methods and policy]

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

[Textbooks]

Continue to 工学部国際インターンシップ２(2)↓↓↓

ＧＬセミナーＩＩ（課題解決演習）**(2)**

[Textbooks]

Will be indicated as necessary.

[References, etc.]

（**Reference books**）
Will be indicated as necessary.

[Study outside of class (preparation and review)]

Will be indicated as necessary.

（Other information (office hours, etc.)）

Course open period: October to January
How to register the course will be instructed.
*It depends on divisions which students belong to whether the earned credits are admitted as credits required for graduation. Please refer to the syllabus of your division.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

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

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

工学部国際インターンシップ２**(2)**

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

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

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 25003 LJ75　U-ENG25 25003 LJ54　U-ENG25 25003 LJ71		
Course title (and course title in English)	計算機数学（原） Mathematics for Computation	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course deals with numerical calculation method by computer. The goal is to acquire a series of processing methods such as planning processing method, program creation, analysis of results by learning the programming language.

[Course objectives]

The goal is to acquire a series of processing methods such as planning processing method, program creation, analysis of results.

[Course schedule and contents]

(1) Orientation and terminal operation, 2 class
Login method of the terminal of the satellite exercise room, how to operate the editor, etc.
(2) Learn the mechanism of numerical calculation, 2 classes
Understanding the principle of numerical calculation, representation of numbers, errors accompanying calculation.
(3) Basic programming, 3 classes
Acquisition of essential items for programming such as input / output, branch, repeat, variable, array, subprogram and function three times. \ task: sum-difference product quotient, sum of sequence, prime number
(4) Applicative programming, 4 classes
Roots of the equation (dichotomy, Newton's method), numerical integration (Simpson method), simultaneous linear equation (Gauss elimination method), eigenvalue (Jacobi method), differential equation (Runge-Kutta method) Acquire the basic idea of calculation method and do actual programming.
(5) Constructive programming, 3 classes
Acquire about several development problems and solutions, and work on issues.
(6) Confirmation of learning attainment, 1 class
Post explanation and review of examination questions to KULASIS.

[Course requirements]

Recommend to take basic information processing and basic information processing exercises.

[Evaluation methods and policy]

[Grading method]
Grade is based on reports (30%) and one written examination (70%).
[Grading criterion]
Must score 60 or above out of 100 on the reports and written examination
60 or above: pass

Continue to 計算機数学（原）(2)↓↓↓

計算機数学（原）(2)

59 or below: fail

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
戸川隼人 『演習と応用　FORTRAN77』（サイエンス社）ISBN:4781905110
堀之内他 『ANSI C による数値計算法入門 (第2版)』（森北出版）ISBN:4627093829

[Study outside of class (preparation and review)]

As needed, practice exercises will be conducted in class, so please review after class.

（Other information (office hours, etc.)）

Lecture is given in Japanese.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 25003 LJ75　U-ENG25 25003 LJ54　U-ENG25 25003 LJ71		
Course title (and course title in English)	計算機数学（エネ） Mathematics for Computation	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,HACHIYA KAN Graduate School of Energy Science Associate Professor,Jun HAYASHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

To acquire the ability of basic computational programing and learn the basic mathematics underlying the computational programing.

[Course objectives]

To acquire the ability of basic computational programing and learn the basic mathematics underlying the computational programing.

[Course schedule and contents]

Orientation and Practice of terminal operation, 2times, Lecture on adjust login system of satellite lecture room; Lecture on the procedure to build up the computational environment
Basics of the numerical computational language, 2times, Lecture on the basics of the numerical computation, 3times, Input/Output; Subroutine; etc.// Exercise of the arithmetic operations, Sequences, etc.
Basic programing, 4times, Lecture on the basics of approximations of roots of the real-valued function (Newton's method), numerical integration (Simpson Method); Simultaneous equation (Gaussian elimination), etc.
Advanced programing, 3times, Lecture on the procedure to built a structure of the complicated issues// Exercise of advanced programming.
Summary and confirmation,1time,

[Course requirements]

None

[Evaluation methods and policy]

Comprehensive evaluation of attendance, exercises and examination.

[Textbooks]

Not used

Continue to 計算機数学（エネ）(2)↓↓↓

計算機数学（エネ）(2)

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Learn the basics of FORTRAN and C.
Try to understand the exercises in each lecture.

（Other information (office hours, etc.)）

Check KULASIS/Office Hours

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

(1) Category

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

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

未更新

Course number	U-ENG25 25003 LJ75　U-ENG25 25003 LJ54　U-ENG25 25003 LJ71		
Course title (and course title in English)	計算機数学（材） Mathematics for Computation	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OKUDA HIROSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,2times,
,3times,
,4times,
,3times,
,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.

計算機数学（機：7・9・11組）(2)

[Evaluation methods and policy]

A final examination will be held. In-class reports will be factored in for maximum 40%.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Study and practice the basics of programming (grammar, flowchart, compile, edit, etc).

（Other information (office hours, etc.)）

The order of classes listed above and their timing may differ depending on the year.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25003 LJ75　U-ENG25 25003 LJ54　U-ENG25 25003 LJ71		
Course title (and course title in English)	計算機数学（機：7・9・11組） Mathematics for Computation	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TATSUMI KAZUYA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course focuses on the mathematical and numerical methods for numerical computation. We will learn the mathematical methods to solve mathematical and physical problems by using computers. We will study the programing language and practice programming to learn and experience the process of how to use a program to solve problems, write programs, and analyze the results, and also understand the accuracy and characteristics of the numerical methods.

[Course objectives]

Understand and learn the basic knowledge, method and skill of mathematical solution for computation, planning the numerical method, programming, and analyze the results.

[Course schedule and contents]

Mathematics for numerical simulation (3)
Learn the principle of computation and the mathematical method, and understand the error appearing in the computation.

Orientation and operating the terminal (1)
Access to the computer in the satellite seminar room and how to use the editor, and compile and run a program.

Basic programming (2)
Learn the basic statements and structure of programming (input, output, loop, parameters, array, sub routine, function, etc.)

Applied and practical problems (5)
We will learn the fundamental method and programming of various numerical methods: solution of equation (Bisection method, Newton's method), numerical integration (Simpson’ s method), simultaneous equation (Gaussian elimination), differential equation (Runge-Kutta method), data analysis (least-square method).

Advanced programming (3)
Learn the mathematical method and programming for advanced problems including physical phenomena.

Confirmation of learning attainment. (1)

[Course requirements]

Students are recommended to have completed Information Processing Basics and Exercises in Information Processing Basics.

Continue to 計算機数学（機：7・9・11組）(2)↓↓↓

未更新

Course number	U-ENG25 25003 LJ75　U-ENG25 25003 LJ54　U-ENG25 25003 LJ71		
Course title (and course title in English)	計算機数学（機：8・10・12組） Mathematics for Computation	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Associate Professor,KOUNO DAISUKE Graduate School of Informatics Associate Professor,SAKURAMA KAZUNORI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 計算機数学（機：8・10・12組）(2)↓↓↓

計算機数学（機：8・10・12組）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 25004 LJ77　U-ENG25 25004 LJ71　U-ENG25 25004 LJ75		
Course title (and course title in English)	材料力学 1（機宇：学番偶数） Mechanics of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HIRAKATA HIROYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

0

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25004 LJ77　U-ENG25 25004 LJ71　U-ENG25 25004 LJ75		
Course title (and course title in English)	材料力学 1（機宇：学番奇数） Mechanics of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HOUJIYOU MASAKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25004 LJ77　U-ENG25 25004 LJ71　U-ENG25 25004 LJ75		
Course title (and course title in English)	材料力学 1（材エネ原：学番奇数） Mechanics of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Concepts of Mechanics of Materials,2times,
Subjects on Simple Stress States,3times,
Strain Energy,2times,
Bending of Beams,5times,
Complex beams,2times,
,1time,

[Course requirements]

Fundamentals of Mathematics and Physics

[Evaluation methods and policy]

[Textbooks]

ISBN:4-563-03465-7
(Zairyo Rikigaku no Kiso, Shibata, Ohtani, Komai, Inoue, Baifukan) isbn{}{4563034657}

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25004 LJ77　U-ENG25 25004 LJ71　U-ENG25 25004 LJ75		
Course title (and course title in English)	材料力学１（材エネ原：学番偶数） Mechanics of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,ABE MASATAKA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 25005 LJ71　U-ENG25 25005 LJ75　U-ENG25 25005 LJ77		
Course title (and course title in English)	材料力学２（機：7,8,9,10組） Mechanics of Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NISHIKAWA MASAAKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

The simplified one-dimensional treatments lectured in Mechanics of Materials 1 are extended to include more complex two- or three-dimensional problems. Analytical methods for the deformation and the stresses in various structural members are lectured including the combined stress states.

[Course objectives]

The emphasis is to understand the fundamental concepts and methods for the stress/strain analysis of various structures or struictural members, by advancing the basic principles given in Mechanics of Materials 1.

[Course schedule and contents]

1-2. Beam bending
(Beam bending, Castigliano's theorem)
3-5. Advanced problems of beams
(Statically indeterminate beams, Continuous beams, Curved beams)
6-9. Basics of elasticity
(Combined stress states, Mohr's stress and strain circles, Equilibrium equations, Displacement-strain relations, Stress-strain relations, Plane stress or strain states, Relation between elastic constants)
10-11. Torsion
(Torsion of circular bars, Coil springs, Combination of bending and torsion)
12. Buckling
(Buckling of column, Instability, Effect of support conditions, Buckling design)
13-14. Axially symmetric problems and bending of plates
(Circular cylinders, Spherical shells, Rotating circular plates, Cylindrical bending, Bending rigidity)
15. Feedback

Academic achievement assessment: Regular examination

* The order and the hours (weights) for each item are possibly subject to change.

[Course requirements]

Mechanics of Materials 1, and other subjects such as calculus, linear algebra, mechanics of particles and rigid bodies.

[Evaluation methods and policy]

[Evaluation method]
Evaluation is based on the mid-term and the final examinations,

Continue to 材料力学２（機：7,8,9,10組）(2)↓↓↓

possibly with considerations of short reports (about three times).
(In the cases where the evaluation for short reports are considered, the ratio of the evaluations for regular examination and short reports is about 9:1.)
[Evaluation standard]
Evaluation is based on class registration guideline.

[Textbooks]

T. Shibata et al. 『Fundamentals of Strength of Materials (Zairyo-Rikigaku no Kiso)』（Baifu-kan）ISBN: 4563034657

[References, etc.]

（**Reference books**）
To be referred to during the course

[Study outside of class (preparation and review)]

It is highly recommended to make the preparation and review with the specified textbook. Homework (short reports: about three times) will be assigned.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 25005 LJ71　U-ENG25 25005 LJ75　U-ENG25 25005 LJ77		
Course title (and course title in English)	材料力学２（機：11,12組、宇） Mechanics of Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,BIWA SHIROU
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

The basic treatments given in Mechanics of Materials 1 are extended to problems such as bending of statically indeterminate beams, torsion of bars, buckling of columns, cylindrical vessels subjected to internal/external pressures. More general treatments of stresses and strains and their relations in two- or three-dimensional cases are also explained.

[Course objectives]

The aim of this subject is to understand the analytical methods for structural members subjected to various types of loading, and the treatments of two- or three-dimensional stresses and strains, based on the basic ideas learnt in Mechanics of Materials 1.

[Course schedule and contents]

The following topics are discussed in the lecture, but subject to possible changes according to each year's situations.
Week 1: Bending of beams (basic equations, Castigliano's theorem, solution methods)
Week 2: Complex problems of beams (statically indeterminate beams, curved beams)
Week 3: Fundamentals of elasticity (1) (definition of stress, equilibrium equations)
Week 4: Fundamentals of elasticity (2) (stresses on an arbitrarily inclined plane, Mohr's circle of stress)
Week 5: Fundamentals of elasticity (3) (principal stresses, correspondence to eigenvalue problems)
Week 6: Fundamentals of elasticity (4) (definition of strain)
Week 7: Fundamentals of elasticity (5) (strains in an arbitrary direction, Mohr's circle of strain)
Week 8: Fundamentals of elasticity (6) (generalized Hooke's law, plane stress/plane strain, relation among elastic constants)
Week 9: Mid-term examination
Week 10: Torsion of bars (1) (torsion of bars of circular cross-section)
Week 11: Torsion of bars (2) (coil springs, combined bending and torsion)
Week 12: Buckling of columns (buckling loads, column under eccentric loading, buckling design)
Week 13: Axially symmetric problems (basic equations, thick-walled and thin-walled cylinders)
Week 14: Bending of plates; Solution of related problems
Week 15: Final examination
Week 16: Feedback

Continue to 材料力学２（機：11,12組、宇）(2)↓↓↓

材料力学２（機：11,12組、宇）(2)

[Course requirements]

Understanding of Mechanics of Materials 1 and other basic subjects such as calculus, linear algebra, and mechanics of particles and rigid bodies is prerequisite.

[Evaluation methods and policy]

Grading is made based on the mid-term examination (50%) and the final examination (50%), but the weight of each examination is subject to change. Class-room tests and/or reports may also be considered. The total score is evaluated between 0 and 100 points (the pass mark is 60).

[Textbooks]

T. Shibata et al. 『Fundamentals of Strength of Materials (Zairyo-Rikigaku no Kiso)』（Baifu-kan）ISBN: ISBN4-563-03465-7

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Contents of Mechanics of Materials should be fully reviewed. Reports will be assigned, which need to be solved as homeworks. In addition, it is desirable that an enrolled student work on the textbook by him/herself prior or after each lecture.

（Other information (office hours, etc.)）

Lectures are given in a black-board style. Students are expected to take the notes to understand the ideas as well as mathematical derivations, and make questions regarding unclear points.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25007 LJ71 U-ENG25 25007 LJ57 U-ENG25 25007 LJ77		
Course title (and course title in English)	熱力学２（機宇：学番奇数） Thermodynamics 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKABE KAZUYOSHI Graduate School of Engineering Associate Professor,TATSUMI KAZUYA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,2times,
,2times,
,6times,
,2times,
,1time,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25005 LJ71 U-ENG25 25005 LJ75 U-ENG25 25005 LJ77		
Course title (and course title in English)	材料力学２（材エネ原） Mechanics of Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25007 LJ71 U-ENG25 25007 LJ57 U-ENG25 25007 LJ77		
Course title (and course title in English)	熱力学２（機宇：学番偶数） Thermodynamics 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,YOSHIDA HIDEO Graduate School of Engineering Professor,IWAI HIROSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

0

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25007 LJ71　U-ENG25 25007 LJ57　U-ENG25 25007 LJ77		
Course title (and course title in English)	熱力学２（エネ原） Thermodynamics 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,ISHIYAMA TAKUJI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

材料基礎学１（機宇：学番奇数）(2)

[Textbooks]

isbn:4901381008 be sold at 日本材料学会事務所（http://www.jsms.jp/index.html)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Read the textbooks before each class, and ascertain the knowledge after the class.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35008 LJ71　U-ENG25 35008 LJ77		
Course title (and course title in English)	材料基礎学１（機宇：学番奇数） Fundamentals of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TOMITA NAOHIDE
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Introductory class to teach fundamentals for Material Science.

[Course objectives]

[Course schedule and contents]

Bonding and structure of materials: Crystal structure, defects in crystals, structure and properties of polymers etc.: 3times

Plastic deformation and fracture: Crystal defect and fracture etc.: 3times

Phase diagram: The phase rule, binary system diagram, ternary phase diagram etc. ,2times

Solidification and phase transformation, deposition etc.: 2times

Processing: Hot and cold processing, recrystallization etc. 1-2times

Steel: Steel processing, material, heat treatment, transformation etc.: 2-3times

feedback lesson: 0-1 time

Confirmation of learning achievement: by reports and a test

[Course requirements]

None

[Evaluation methods and policy]

reports and a test

Continue to 材料基礎学１（機宇：学番奇数）(2)↓↓↓

未更新

Course number	U-ENG25 35008 LJ71　U-ENG25 35008 LJ77		
Course title (and course title in English)	材料基礎学１（機宇：学番偶数） Fundamentals of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HIRAKATA HIROYUKI Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Introductory class to teach fundamentals for Material Science.

[Course objectives]

[Course schedule and contents]

[Course requirements]

None

[Evaluation methods and policy]

reports and a test

[Textbooks]

isbn:4901381008 be sold at 日本材料学会事務所（http://www.jsms.jp/index.html)

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35008 LJ71　U-ENG25 35008 LJ77		
Course title (and course title in English)	材料基礎学１（エネ原） Fundamentals of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

In this course, we discuss the properties that are important in selecting and using materials, as well as basic information for understanding these properties, focusing on metal.

[Course objectives]

The goal of the course is for students to acquire the basic knowledge they need to pursue further studies in materials science and gain the ability to investigate appropriate materials in experimentation and design.

[Course schedule and contents]

(1) Structure of matter, 4 classes: Explain the size of the atoms that are the basis of matter and their electron configuration, types of bonds between atoms, the positions of electrons in solid matter, density and thermal expansion, and so on.
(2) Production of materials, 3 classes: Explain redox and the coagulation of melts, phase equilibrium of materials comprised of two or more chemical elements, and other information concerning the composition of materials.
(3) Mechanical properties, 2 classes: Explain properties related to the structural materials used to support loads such as elastic deformation and plastic deformation, yield strength, creep, and so on.
(4) Change in properties, 2 classes: Explain factors behind the change in the mechanical properties of materials such as addition of chemical elements, annealing, normalizing, quenching, and so on, as well as the reasons for these factors.
(5) Functions of materials, 2 classes: Explain the main functional properties of materials such as conduction of heat and electricity, specific heat, penetration of light, magnetism, and so on.
(6) Resources and recycling, 1 class: Discuss information concerning sustainable development such as abundance and reserves of chemical elements, recycling of materials, and so on.
(7) Confirmation of learning attainment, 1 class: Post explanation and review of examination questions on KULASIS.

[Course requirements]

None

[Evaluation methods and policy]

[Grading method]
Grade is based on one written examination.
[Evaluation standard]
Must score at least 60 out of 100 on the written examination
60 or above: pass

Continue to 材料基礎学１（エネ原）(2)↓↓↓

未更新

Course number	U-ENG25 25009 LJ71		
Course title (and course title in English)	計測学（機エネ原：学番奇数） Scientific Measurement	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Professor,YOKOKAWA RYUUJI Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI Graduate School of Energy Science Associate Professor,MIYAKE MASAO
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Basics of scientific insturmentaion is covered.

[Course objectives]

Understanding of the basics of scientific instrumentation in engineering physics.

[Course schedule and contents]

Units and Standards,2times,Units and Standards
Measurement uncertainity and its evaluation,3times,Measurement uncertainity and its evaluation
Data processing and statistical analysis,3times,Data processing and statistical analysis
Electrical and tempeature measurement,2times,Electrical and tempeature measurement
Radiation and material measurement,2times,Radiation and material measurement
Mechanical measurement,2times,Mechanical measurement
level of attainment,1time,level of attainment

[Course requirements]

None

[Evaluation methods and policy]

Examination. Reports are considered also.

[Textbooks]

小寺秀俊、神野郁夫、鈴木亮輔、田中功、冨井洋一、中部主敬、箕島弘二、横小路泰義『計測工学』（朝倉書店）ISBN:9784254201598

Continue to 計測学（機エネ原：学番奇数）(2)↓↓↓

59 or below: fail

[Textbooks]

In addition, printouts will be distributed in class.

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Practice problems and their solutions will be discussed in class, so please review after class.

（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

[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

未更新

Course number	U-ENG25 25009 LJ71		
Course title (and course title in English)	計測学（機エネ原：学番偶数） Scientific Measurement	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Professor,YOKOKAWA RYUUJI Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI Graduate School of Energy Science Associate Professor,MIYAKE MASAO
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Basics of scientific insturmentaion is covered.

[Course objectives]

Understanding of the basics of scientific instrumentation in engineering physics.

[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]

None

[Evaluation methods and policy]

Examination. Reports are considered also.

[Textbooks]

小寺秀俊、神野郁夫、鈴木亮輔、田中功、冨井洋一、中部主敬、箕島弘二、横小路泰義 『計測工学』（朝倉書店）ISBN:9784254201598

Continue to 計測学（機エネ原：学番偶数）(2)↓↓↓

未更新

Course number	U-ENG25 25012 LJ77　U-ENG25 25012 LJ75　U-ENG25 25012 LJ52		
Course title (and course title in English)	固体物理学（材エネ原宇） Solid State Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Introduction to microscopic solid state physics

[Course objectives]

Gateway to atomic and electronic theories for meterials

[Course schedule and contents]

Crystal and lattice, Diffraction by crystal, Bonding energy of crystal, 2times, Lattice and crystal structure, Miller indices, Bragg's law, vanishing rule and structure factor, repulsion and attraction between atoms, various atomic bonding
Phonon, 2times, Sound wave in elastic body, dispersion relation, Brillouin zone, acoustic mode and optical mode, phonon
Introduction to statistical mechanics, Specific heat of solid, 3times, Introduction to statistical mechanics, Boltzman distribution, entropy, state sum and free energy, Einstein model for specific heat of solid, Debye model for specific heat of solid, thermal expansion of solid
Introduction to quantum mechanics, 3times, Introduction to quantum mechanics, Shrodinger equation, free electron/harmonic oscillator/hydrogen atom, physical quantities and operators
Free electron model. Thermal and transport properties of metal,3times,Density of states, Fermi-Dirac distribution, electron specific heat, resistivity of metals, Hall effect, thermal conductivity of metals
Electrons in periodic potential, 1time, Effects of periodic potential, energy bands, metal/semiconductor/insulator
Assessment, 1time, Assessment

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on a final examination.

Continue to 固体物理学（材エネ原宇）(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

[Textbooks]

M. Shiga 『Introduction to Solid State Physics for Materials Scientists』（Uchidarokakuho）ISBN:9784753655526（in Japanese）

[References, etc.]

（**Reference books**）
C. Kittel 『Introduction to Solid State Physics』（Wiley）ISBN:9780471415268

[Study outside of class (preparation and review)]

Knowledge on quantum mechanics and statistical mechanics is highly helpful.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35013 LJ52　U-ENG25 35013 LJ77		
Course title (and course title in English)	応用電磁気学（機宇：学番奇数） Applied Electromagnetism	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2?3times,
,3?4times,
,2?4times,
,3?5times,
,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.

応用電磁気学（機宇：学番偶数）**(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

未更新

Course number	U-ENG25 35013 LJ52　U-ENG25 35013 LJ77		
Course title (and course title in English)	応用電磁気学（機宇：学番偶数） Applied Electromagnetism	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SUZUKI MOTOFUMI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 応用電磁気学（機宇：学番偶数）(2)↓↓↓

未更新

Course number	U-ENG25 35013 LJ52　U-ENG25 35013 LJ77		
Course title (and course title in English)	応用電磁気学（エネ原） Applied Electromagnetism	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SAITOU MANABU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 応用電磁気学（エネ原）(2)↓↓↓

応用電磁気学（エネ原）(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.

原子物理学（材エネ原宇）(2)

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

原子物理学(菊池，共立出版) isbn{}{4320030478},
原子物理学（シュポルスキー，東京図書） isbn{}{4489001452}など

[Study outside of class (preparation and review)]

講義に関連した啓蒙書などを読み，歴史の中で生まれた物理学を理解することが望ましい.

（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
(間嶋) 株式会社コンポン研究所　4年
(神野) 日本原子力研究所　5.5年

(3) Details of practical classes delivered based on instructors' practical work experience
研究所での経験を活かして，最先端の技術開発や応用研究との関連を講義している.

未更新

Course number	U-ENG25 25014 LJ52　U-ENG25 25014 LJ57　U-ENG25 25014 LJ75		
Course title (and course title in English)	原子物理学（材エネ原宇） Atomic Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KANNO IKUO Graduate School of Engineering Associate Professor,MAJIMA TAKUYA

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

量子力学の発見につながる物理現象の概説を行う．次に，原子や分子などの微視的世界における様々な現象とそこから導かれる諸法則について、具体的な例を交えながらわかりやすく概観し、量子力学への入門とする.

[Course objectives]

古典物理学では記述できない現象を理解する．また原子や分子に関連する微視的世界における諸法則を理解し，量子力学へ向けた基礎知識を習得することを目標とする.

[Course schedule and contents]

原子論,1回,自然哲学的原子論，化学的原子論，原子と原子核，原子核の構造と素粒子，現在の素粒子像
気体分子運動論,2回,化学反応的原子論，気体分子運動論の基本仮定，気体の圧力と温度，物質の比熱，分子のエネルギーと速度の分布則
熱輻射とエネルギー量子,2回,熱輻射の諸性質，Stefan-Boltzmannの法則，Wienの変位則，古典論的輻射公式 (Rayleigh-Jeans, Wien)，Planckの輻射公式とエネルギー量子
光子と電子,2回,電子とその粒子的諸性質，電子の発見，ベータ粒子，光子: 光の粒子性，光電効果，コンプトン効果
原子模型,2回,電子と原子構造，長岡の原子模型とThomsonの原子模型，Rutherfordの原子模型(原子核の発見)，Bohrの原子模型(原子構造への量子論的アプローチ) \量子条件，電子の波動性
シュレディンガー方程式,3回,波動と波束，ド・ブロイ波の性質，不確定性関係，Schr{ouml}dinger方程式(量子力学),
シュレディンガー方程式の解,2回, Schr{ouml}dinger方程式の解，ポテンシャル障壁の反射と透過，量子トンネル効果，弦の振動とポテンシャル箱の中の粒子，水素原子
学習到達度の確認,1回,これまでの学習について到達度の確認を行う.

[Course requirements]

古典力学，電磁気学，熱力学

[Evaluation methods and policy]

成績評価は試験による．素点で評価する.

Continue to 原子物理学（材エネ原宇）(2)↓↓↓

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 （機：学番奇数） Quantum Physics 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SUZUKI MOTOFUMI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Introduction,1~2times,
Fundamentals of quantum mechanics,4times,
Particles motion in one dimension,2~3times,
Harmonic oscillator,2~3times,
Atomic structure,4times,
Assessment of achievement,1time,

[Course requirements]

None

[Evaluation methods and policy]

examination and homework

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 量子物理学 1 （機：学番奇数）(2)↓↓↓

量子物理学１（機：学番奇数）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

Course number	U-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	Graduate School of Engineering Associate Professor,MIYADERA TAKAYUKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.2	Class style	Lecture
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.

[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

[Evaluation methods and policy]

【Evaluation method】
Evaluation will be based on one written examination.
【Evaluation policy】
The result of a written examination should be 60 and above out of 100.

Continue to 量子物理学１（材原宇）〈情報〉(2)↓↓↓

未更新

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（機：学番偶数） Quantum Physics 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

0

[Course requirements]

None

[Evaluation methods and policy]

examination and homework

[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.

量子物理学１（材原宇）〈情報〉(2)

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

未更新

Course number	U-ENG25 45019 LJ77　U-ENG25 45019 LJ71　U-ENG25 45019 LJ75		
Course title (and course title in English)	量子物理学２（機） Quantum Physics 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HASUO MASAHIRO
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,3times,
,3times,
,1?2times,
,1?2times,
,2times,
,3times,
,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.

量子物理学２（材原宇）〈情報〉(2)

[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

Course number	U-ENG25 45019 LJ77　U-ENG25 45019 LJ71　U-ENG25 45019 LJ75		
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	Graduate School of Engineering Associate Professor,MIYADERA TAKAYUKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.1	Class style	Lecture
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.

[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 one written examination.
【Evaluation policy】
The result of a written examination should be 60 and above out of 100.
60 and above: Passed
59 and below: Failed

Continue to 量子物理学２（材原宇）〈情報〉(2)↓↓↓

未更新

Course number	U-ENG25 35020 LJ71		
Course title (and course title in English)	連続体力学（エネ） Continuum Mechanics	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Basic assumptions,1 times,
Vectors and tensors,2times,
Fundamental laws,2 times,
Constitutive framework,3times,
Potential theories,2times,
Wave motions,2times,
Stabilities,2times,
Examination,1 times,

[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.

Course number	U-ENG25 35020 LJ71		
Course title (and course title in English)	連続体力学（機） Continuum Mechanics	Instructor's name, job title, and department of affiliation	Institute for Frontier Life and Medical Sciences Professor,ADACHI TAIJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture provides an introduction to the theory of continuum mechanics for its application to the fields of bioengineering and biomedical engineering.

[Course objectives]

Students will be able to understand tensor analysis and continuum mechanics, and to apply them in modeling of living tissues and cells.

[Course schedule and contents]

１）Introduction to continuum mechanics

２）Mathematical preliminaries
Matrix algebra, Index notation, Summation convention, Eigenvalues and eigenvectors

３，４）Vectors and tensors
Cartesian tensors, Scalar and vector products, Dyadic product, Coordinate transformation,Invariants, Nabla operator, Divergence theorem

５，６）Kinematics
Bodies and configurations, Displacement, Strain tensor, Compatibility, Material time derivative

７，８）Stress and equilibrium
Force and stress, Stress tensor, Traction, Cauchy stress, Principal stresses, Equation of equilibrium

９，１０）Conservation Laws and governing equations
Mass conservation, Linear and angular momentum, The first law of thermodynamics for continua

１１，１２）Constitutive models
Constitutive equations, Stress-strain relationship, Linear elasticity, Newtonian viscous fluids,Material symmetry, Biological tissues

１３，１４）Boundary value problems
Differential equations with a set of boundary conditions, Navier-Stokes equation, Navier's equation

１５）Feedbacks
Application of continuum mechanics to the analyses of biological tissues, Introduction to biomechanics

Continue to 連続体力学（機）(2)↓↓↓

未更新

Course number	U-ENG25 35023 LJ71　U-ENG25 35023 LJ77　U-ENG25 35023 LJ28		
Course title (and course title in English)	エネルギー変換工学（機エネ） Energy Conversion	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKABE KAZUYOSHI Graduate School of Energy Science Professor,ISHIYAMA TAKUJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Various energy sources and energy conversion systems will be outlined. Also, basic matters on energy conversion processes and thermodynamics treatments for the effective use of energy will be lectured.

[Course objectives]

From this class, fundamental issues related to energy conversion engineering are learned, as well as a target is put in the current situation of energy resources, latest technologies of energy conservation and new energy system, environmental measures are comprehensible.

[Course schedule and contents]

Energy source and energy conversion system,3?4times,* Energy resources
,3?4times,
,3?4times,
,3?4times,

[Course requirements]

Knowledge of thermodynamics is required.

[Evaluation methods and policy]

Achievement will be synthetically evaluated from attendance, report and final examination.

[Textbooks]

Nothing. Print material is properly distributed.

[References, etc.]

（**Reference books**）
It will be introduced, if necessary.

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

連続体力学（機）(2)

[Course requirements]

None

[Evaluation methods and policy]

Exam 100 (+ Reports max 10)

[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.

未更新

Course number	U-ENG25 35023 LJ71　U-ENG25 35023 LJ77　U-ENG25 35023 LJ28		
Course title (and course title in English)	エネルギー変換工学（原） Energy Conversion	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,KAWARA ZENSAKU Graduate School of Engineering Professor,YOKOMINE TAKEHIKO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35024 LJ71　U-ENG25 35024 LJ77		
Course title (and course title in English)	振動工学（機） Vibration Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Graduate School of Engineering Professor,KOMORI MASAHARU Graduate School of Engineering Professor,MATSUBARA ATSUSHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 振動工学（機）(2)↓↓↓

未更新

Course number	U-ENG25 35024 LJ71　U-ENG25 35024 LJ77		
Course title (and course title in English)	振動工学（宇） Vibration Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,AOI SHINYA Graduate School of Engineering Professor,SENDA KEI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[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.

振動工学（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 35025 LJ77　U-ENG25 35025 LJ71		
Course title (and course title in English)	制御工学 1 （機エネ原：学番奇数） Control Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUNO FUMITOSHI Graduate School of Engineering Associate Professor,ＥＮＤＯ　ＴＡＫＡＨＩＲＯ
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35025 LJ77　U-ENG25 35025 LJ71		
Course title (and course title in English)	制御工学１（機エネ原：学番偶数） Control Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Informatics Professor,OOTSUKA TOSHIYUKI Graduate School of Informatics Associate Professor,SAKURAMA KAZUNORI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Control Engineering provides a methodology of controlling various systems including mechanical ones in a systematic way. Its major part consists of both Classical Control Theory and Modern Control Theory. This class describes the fundamentals of Classical Control Theory.

[Course objectives]

The course goal is to understand the basic concepts of Classical Control Theory such as transfer functions, frequency responses and stability.

[Course schedule and contents]

Introduction,1time,The basic idea of Control Engineering such as the purpose and methods of control is described through various real world examples.
Representation of dynamical systems,2-3times,Mathematical description of systems is developed first. Then, the concept of Transfer Functions is introduced based on Laplace Transform, and Block diagram representation is shown.
Responses of dynamical systems,3times,Time responses of linear systems are shown. Stability of systems and Stability tests are described.
Properties of feedback systems,2-3times,Basic properties such as steady state characteristics of feedback control systems and Root Locus are explained.
Frequency responses,3-4times,The concept of Frequency responses, Bode diagrams, Vector locus are introduced. The stability test of feedback systems based on the frequency responses is explained.
Design of control systems,2times,Basic components of classical controller design methods such as Phase lead, Phase Lag, and PID compensation are described.

[Course requirements]

Elementary knowledge of Laplace Transform is required.

[Evaluation methods and policy]

Scores of quizzes, reports and the regular examination are taken into account.

Continue to 制御工学１（機エネ原：学番偶数）(2)↓↓↓

未更新

Course number	U-ENG25 35025 LJ77　U-ENG25 35025 LJ71		
Course title (and course title in English)	制御工学１（宇） Control Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,MARUTA ICHIROU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Control engineering consists of theory and methodology to design control systems. It includes the classical control theory to design feedback control systems based on transfer functions and frequency response.

[Course objectives]

The goal of this course is to understand the classical control theory and the related methodologies to design feedback control systems based on transfer functions and frequency response.

[Course schedule and contents]

1. Introduction
History and background of control engineering
2-5. Dynamical systems and transfer functions
Basic knowledge on dynamical systems, ordinary differential equations, transfer functions and block diagrams
6-8. Transit response and stability
Stability of dynamical systems, transit response, steady response and Routh-Hurwitz stability criteria
9-10. Frequency response
Basic knowledge on frequency response using Bode plots and vector locus
11-13. Characteristic of feedback control systems
Performance criteria of feedback control systems using Nyquist's stability criteria and the root locus method.
14-15. Design of feedback control system,
How to design feedback control system using phase-lead compensation, phase-lead-lag compensation and PID control

[Course requirements]

Complex function theory, Ordinary differential equation theory

[Evaluation methods and policy]

Evaluation will be based on the final examination which determines the degree of comprehension of the basic concepts and the design theory of feedback systems.
Also, the reports and assignments will be added up to one third of the points lost in the final examination.

[Textbooks]

T. Sugie and M. Fujita 『Introduction to feedback control』（Corona Publisher）ISBN:4339033030（in Japanese）

Continue to 制御工学１（宇）(2)↓↓↓

[Textbooks]

T. Sugie, M. Fujita: Introduction of Feedback Control. Corona Publishing Co. Ltd. isbn{}{9784339033038}

[References, etc.]

（**Reference books**）
T. Sugie, H. Kajiwara: Exercises in System Control Engineering. Corona Publishing Co. Ltd. isbn{}{ 9784339033069}

（**Related URLs**）

(none)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Some parts of the above contents may be skipped/added depending on the course schedule of the year.

*Please visit KULASIS to find out about office hours.

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

To read through textbooks as the lecture progresses.
Also, review the parts of the textbook instructed according to the achievement level of the assignments.

（Other information (office hours, etc.)）

Feedback on lecture understanding is made from time to time according to the degree of achievement of the assignments.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35027 LJ71		
Course title (and course title in English)	制御工学２（機） Control Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUNO FUMITOSHI Graduate School of Engineering Associate Professor,ＥＮＤＯ　ＴＡＫＡＨＩＲＯ

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Wed.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

制御工学２（宇）(2)

[Evaluation methods and policy]

The points will be evaluated based on the score of the paper test. The report assignment and attendance point may adds auxiliary points. The goal of this course is to understand the outline of the modern control and to acquire the ability to design the control system.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

Introduced during class

[Study outside of class (preparation and review)]

We will give a report for each unit. Review is necessary after every lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35027 LJ71		
Course title (and course title in English)	制御工学２（宇） Control Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,FUJIMOTO KENJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Thu.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course treats modern control theory based on state-space models of dynamical systems. It includes modeling, analysis and synthesis methods of feedback control systems.

[Course objectives]

Students will learn state-space equations, stability analysis, feedback controller synthesis and observer design.

[Course schedule and contents]

The basic schedule of the course is as follows.

1. Introductions
2. Ordinary differential equations and state-space equations
3. Eigenvalues, eigenvectors and systems
4. Solutions of state-space equations
5. Stability
6. Transfer functions and realization theory
7. Controllability
8. Observability
9. Coordinate transformation and canonical decomposition
10. Controllability canonical form
11. Observability canonical form
12. State feedback control
13. State observers and output feedback control
14. Optimal control and Kalman filters
15. Summary

[Course requirements]

Students are required to take basic knowledge of linear algebra and differential equation theory. I is also preferable to take Control Engineering 1.

Continue to 制御工学２（宇）(2)↓↓↓

未更新

Course number	U-ENG25 35030 LJ71		
Course title (and course title in English)	生産工学（機） Production Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,IZUI KAZUHIRO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course deals with how to construct and operate a manufacturing system of a mechanical product.

[Course objectives]

The goal is to understand the concept of a manufacturing system, and to become able to handle related basic decision-making problems.

[Course schedule and contents]

Introduction,1time,The overall concept of a manufacturing system is given.
Industrial Economics,2times,After introducing the concept of the manufacturing cost and cash flow, how to make decisions using the concept (for example, the DCF method for investment decisions) is addressed.
Production amp Operations Management,2times,Demand forecasting, production planning, inventory management, MRP, JIT, etc. are covered.
,3times,
Production Scheduling,2times,Basic approaches for single machine scheduling, flow shop scheduling, job shop scheduling, and project scheduling are introduced.
Plant Layout amp Line Blancing,2times,Basic approaches for plant layout and line balancing are introduced.
Industrial Engineering,2times,After introducing the principles of motion economy, the approaches for process analysis, human-machine analysis, Therblig analysis, standard time setting, etc. are addressed.
,1time,

[Course requirements]

None

[Evaluation methods and policy]

The regular examination, in-class examinations and reports are taken into account.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Homework problems are assigned.

（Other information (office hours, etc.)）

The topics covered may be modified from the plan according to the actual schedule.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35035 LJ75		
Course title (and course title in English)	結晶物性学（材エネ） Physics of Crystal Properties and Imperfections	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,INUI HARUYUKI Graduate School of Engineering Associate Professor,KISHIDA KIYOUSUKE
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Dislocations are the most important lattice defects that strongly affect various propieties, especially mechanical properties of crystalline materials. In this course, fundamental properties of dislocations as well as basics of elasticity will be lectured.

[Course objectives]

This class aims to help students to acquire fundamental understandings of dislocations and also to acquire ways to understand mechanical properties of crystalline materials based on dislocation theory.

[Course schedule and contents]

(1) Introduction to dislocations [1 week]:
(2) Basics of elasticity theory [5 weeks]
(3) Elastic properties of dislocations [2 weeks]
(4) Motion of dislocations [2 weeks]
(5) Force on dislocations [4 weeks]
(6) Feedback [1 weeks]

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on one (or two) written examination(s). Attendance and daily reports may be considered in grading determination.

[Textbooks]

Hand out materials will be provided during the lecture.

[References, etc.]

（**Reference books**）
鈴木秀次 『転位論入門』（アグネ）ISBN:4750702315
J.P. Hirth and J. Lothe 『Theory of Dislocations』（McGraw-Hill）ISBN:TY86299777
J.P. Hirth and J. Lothe 『Theory of Dislocations, 2nd ed.』（Wiley）ISBN:047109125
幸田成康 『金属物理学序論』（コロナ）ISBN:9784339042870
柴田俊忍[ほか]共著 『材料力学の基礎』（培風館）ISBN:4563034657

Continue to 結晶物性学（材エネ）(2)↓↓↓

Course number	U-ENG25 35036 LJ76　U-ENG25 35036 LJ62　U-ENG25 35036 LJ75		
Course title (and course title in English)	材料物理化学（原） Physical Chemistry of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course deals with physicochemical information on nuclear energy materials such as production of fuel and soundness of materials, examining their principles and practical examples.

[Course objectives]

The goal of the course is to study fission reactors and nuclear fusion reactors in terms of physical chemistry, for instance thermodynamics, reaction velocity, and mass transfer.

[Course schedule and contents]

(1) Overview of nuclear energy materials, 1 class
Provide an overview of nuclear energy materials and the various steps of the nuclear fuel cycle (mining and refinement of nuclear fuel resources, production and burning of nuclear fuel, storage and reprocessing of spent fuel, treatment and disposal of radioactive waste).
(2) Isotope separation and concentration, 2 classes
Explain the principles (gaseous diffusion process, centrifugal separation process) and methods (separative work units, enrichment cascade) of isotopes such as uranium.
(3) Reaction kinetics, 2 classes
Provide an overview of thermodynamics and reaction kinetics and explain order of reaction and rate constant determination methods, along with the influence of temperature.
(4) Soundness of atomic reactor materials, 2 classes
Outline the structure of atomic reactors from the perspectives of materials and cross-sections and explain the influence of radiation injury and corrosion on the soundness of materials, as well as the causes of and strategies for dealing with these phenomena.
(5) Nuclear fusion reactor fuel and materials, 3 classes
Explain the structure of nuclear fusion reactors from the perspectives of materials and cross-sections and explain the production and permeation leakage of the hydrogen isotopes that fuel nuclear fusion reactors, as well as the radioactivation of structural material.
(6) Materials and radiation, 2 classes
Discuss the radiation effect as a problem common to all nuclear energy materials and explain the influence of material properties and radiation.
(7) Oxides and atomic fuel, 2 classes
Explain the behavior of atomic fuel and fission products in reactors using oxygen potential and phase diagrams.
(8) Confirmation of learning attainment, 1 class
Post explanation and review of examination questions to KULASIS.

Continue to 材料物理化学（原）(2)↓↓↓

[Study outside of class (preparation and review)]

To review contents covered in the previous lecture.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Course requirements]

None

[Evaluation methods and policy]

[Grading method]
Grade is based on one written examination.
[Grading criterion]
Must score 60 or above out of 100 on the written examination
60 or above: pass
59 or below: fail

[Textbooks]

No additional. Materials will be distributed in class.

[References, etc.]

（**Reference books**）
M. Benedict, T. H. Pigford and H. W. Levi 『Nuclear Chemical Engineering, 2nd Ed.』（McGraw-Hill ）ISBN:0070045313
Atkins 『アトキンス物理化学 第10版』（東京化学同人）ISBN:9784807909087

[Study outside of class (preparation and review)]

As needed, practice exercises will be conducted in class, so please review after class.

（**Other information (office hours, etc.)**）

Lecture is given in Japanese.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35036 LJ76　U-ENG25 35036 LJ62　U-ENG25 35036 LJ75		
Course title (and course title in English)	材料物理化学（エネ） Physical Chemistry of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,HIRATOU TETSUJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course discusses physical chemistry in relation to materials and raw materials processing. To do so, lectures focus on thermodynamics, solution chemistry, electrochemistry, the sciences that serve as the basis for material production, functional materials processes, recycling, corrosion and corrosion protection, etc.

[Course objectives]

From this course, students will become able to do the following:
1. Thermodynamically estimate aqueous solution reactions (acid-base reaction, oxygen reduction reaction) utilizing the free energy of ion formation.
2. Depict log a-pH diagrams and phase-pH diagrams.
3. Read log a-pH diagrams and phase-pH diagrams.
4. Express simple reaction rate equations in differential and integral form, and determine the reaction rate constant from experiment results.
5. Determine activation energy in relation to reaction rate temperature dependence from an Arrhenius plot.
6. Consider electrode kinetics using the Butler-Volmer equation.
7. Consider corrosion in light of equilibrium theory (Potential-pH diagram).
8. Consider corrosion in light of kinetic theory (Evans diagram, mixed potential model).

[Course schedule and contents]

Fundamentals of chemical thermodynamics (2 classes)
Confirmation is made of the basic items of Gibbs energy, chemical potential and activity, etc., all of which will serve as the foundation for this course.

Equilibrium theory of aqueous solution reactions (6 classes)
Lectures discuss acid-base reactions, oxidation-reduction reactions, and equilibrium electrochemistry, which serve as the foundation for materials processes using aqueous solutions and for corrosion and corrosion prevention.

Reaction rate fundamentals (3 classes)
Explanation is made of chemical reaction rate, dynamic electrochemistry, and solid surface processes, which serve as the foundation for materials processes using aqueous solutions and for corrosion and corrosion prevention.

Corrosion (3 classes)
Lectures will discuss equilibrium theory and kinetics of metal corrosion.

Feedback class (1 class)

Continue to 材料物理化学（エネ）(2)↓↓↓

未更新

Course number	U-ENG25 35037 LJ75　U-ENG25 35037 LJ57		
Course title (and course title in English)	熱及び物質移動（材） Heat and Mass Transfer	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KAWAI JIYUN

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The fundamentals of transport phenomena for the engineers and/or researchers related to physical engineering are given.

[Course objectives]

To be able to apply the fundamental equations of thermal and mass transport studied in the class to real phenomena.

[Course schedule and contents]

One dimensional heat conducion,2times,Difference between heat and temperature. Similarity among heat, mass, and momentum transfers. Fourier#039s law, Steady heat conduction.
Non-steady heat transfer,2times,Diffusion equation, solved by Fourier expansion, Laplace transform, and numerical method.
Conservation rules,1time,Fourier#039s law, Steady heat conduction.
Molecular kinetics,1time,Maxwell#039s theorr.
Heat conduction of cylinder and sphere,1time,Heat transfer of cylindrical and sperical coordinates.
2 dimensional heat conduction,1time,2 dimensional Laplace equation.
Green function,2times,Green function. Relation between Schroedinger equation and diffusion equation.
Hydrodynamics,2times,Navier Stokes equation.
Boundary layer,1time,
Electromagnetic radiation,1time,
Achievement check,1time,Learning how to solve the problems through practical exercises.

[Course requirements]

None

[Evaluation methods and policy]

Assignment and written examination

[Textbooks]

河合著:「物理工学・化学工学を学ぶための熱・物質移動の基礎」丸善(2005) isbn{}{4621076086}

[References, etc.]

（**Reference books**）

Continue to 熱及び物質移動（材）(2)↓↓↓

材料物理化学（エネ）(2)

Via questions and answer using the study support service (PandA), students will gain a deeper understanding of the contents of this course.

[Course requirements]

Students are recommended to have finished the course Energy and Material Thermochemistry I.

[Evaluation methods and policy]

Grading will be performed in principle using scores on regular tests. Consideration may also be given to exercises, quizzes, and reports assigned in classes.

[Textbooks]

Materials will be distributed during class or using the student support service (PandA).

[References, etc.]

（**Reference books**）
『アトキンス物理化学』（東京化学同人）

[Study outside of class (preparation and review)]

Notification will be made via the study support service (PandA).
For each week's class, class contents and quiz answers will be posted on the study support service (PandA).
Students are requested to review and gain a sufficient understanding of these before each next class period.

（Other information (office hours, etc.)）

Problem-solving type assignments will be designated as necessary using practice exercises as well as the study support service (PandA).
Please note also that a portion of course contents may be omitted, or additional content may be added, depending on the progress of the course during each specific academic year.

*Please visit KULASIS to find out about office hours.

熱及び物質移動（材）(2)

（Related URLs）

((50370) http://www.process.mtl.kyoto-u.ac.jp/)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35037 LJ75　U-ENG25 35037 LJ57		
Course title (and course title in English)	熱及び物質移動（エネ） Heat and Mass Transfer	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,OKUMURA HIDEYUKI Graduate School of Energy Science Professor,SAGAWA TAKASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35041 LJ52　U-ENG25 35041 LJ53		
Course title (and course title in English)	量子反応基礎論（原） Fundamentals of Particle Interactions	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SAITOU MANABU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,4times,
,2times,
,2times,
,2times,
,2times,
, 1 times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35040 LJ77　U-ENG25 35040 LJ59　U-ENG25 35040 LJ52		
Course title (and course title in English)	プラズマ物理学（原宇） Plasma Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MURAKAMI SADAYOSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Fundamental properties of plasma as a universal state of high-temperature matters, basic equation describing plasma, magnetohydrodynamics, plasma waves and transport phenomena are explained.

[Course objectives]

to understand basic properties of plasmas and learn fundamental method of analysis

[Course schedule and contents]

What is a plasma?,2times,
Motion of charged particles,2times,
Coulomb collision,1time,
Basic equations,2times,
Equilibrium and stability,1time,
Plasma waves,2times,
Wave-particle interaction,1time,
Transport phenomena,1time,
Gas discharge,1time,
Nuclear fusion,1time,
Confirmation of achievement,1time,

[Course requirements]

Basic knowledges of electromagnetism, statistical physics, fluid dynamics and atomic physics are expected.

[Evaluation methods and policy]

semester-end examination and reports

[Textbooks]

Hand out will be distributed

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35045 LJ52　U-ENG25 35045 LJ77		
Course title (and course title in English)	気体力学（宇） Gasdynamics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKATA SHIGERU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Dynamics of high speed gas flows is treated on the basis of the fluid dynamics for compressible inviscid fluid. In this course, one-dimensional and quasi one-dimensional flows are mainly discussed, in order to show typical phenomena coming from the fluid compressibility.

[Course objectives]

To learn/understand fundamental issues specific to compressible fluid flows

[Course schedule and contents]

1. Euler set of equations (2 times)
2. Sound propagation (2 times)-- propagation of infinitesimal disturbance
3. Quasi one-dimension flow (2 times) -- isentropic flow, Laval nozzle, etc.
4. Propagation of finite amplitude disturbance (2 times) -- wave deformation, Riemann invariants, etc.
5. Standing Shock wave (1 times) -- Rankine-Hugoniot relation, etc.
6. Shock tube problem (3 time) -- Riemann problem, Reflection and deflection of waves
7. From one-dimensional to two-dimensional flow (3 times) -- Oblique Shock, Prandtl-Meyer fan, etc.

[Course requirements]

Fluid dynamics 1, Elemental Calculus (A,B, I,II), Linear Algebra (A,B)

[Evaluation methods and policy]

By the final exam., in principle.

[Textbooks]

H. M. Liepmann and A. Roshko 『Elements of Gasdynamics』（Dover Publications）ISBN:0486419630

[References, etc.]

（**Reference books**）

J. D. Anderson, Jr. 『Modern Compressible Flow (2nd ed.)』（McGraw-Hill）ISBN:0071006656

[Study outside of class (preparation and review)]

Students are expected to read the textbook by themselves in accordance with the progress of the class.

（**Other information (office hours, etc.)**）

Actual times and order of topics may change, depending on the class attendants or other reasons. A part of topics might be shifted to the class of Aerodynamics.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35046 LJ52　U-ENG25 35046 LJ77		
Course title (and course title in English)	熱統計力学（宇） Thermodynamics and Statistical Mechanics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ERIGUCHI KOUJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

, 2 times,
, 4 times,
, 3 times,
, 2 times,
, 4 times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 熱統計力学（宇）(2)↓↓↓

未更新

Course number	U-ENG25 35047 LJ52　U-ENG25 35047 LJ77		
Course title (and course title in English)	空気力学（宇） Aerodynamics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKATA SHIGERU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This is the continuation of the class "Gasdynamics (50450)." Mainly treated are two-dimensional inviscid compressible fluid flows and aerodynamic forces acting on the bodies in such flows. A modern approach to gas flows based on the kinetic theory of gases is introduced as well.

[Course objectives]

To learn/ understand the fundamental issues of two-dimensional compressible gas flows related to high speed flight.

[Course schedule and contents]

1. Review of Gasdynamics (2times)-- Shock wave, Mach line, Prandtl-Meyer fan
2. Shock--Expansion wave theory and Interaction of oblique shocks (2times)
3. Non-isentropic flow and Mrocco's theorem (1time) -- Bow shock, Shock--Expansion wave interaction, etc.
4. Small perturbation theory (3times) -- Potential flow, Similarity rules, etc.
5. Steady two-dimensional flow and the method of characteristics (3times)
6. Kinetic theory of gases (4times) -- velocity distribution function, Boltzmann equation, etc.

[Course requirements]

Fluid dynamics 1,2, Gasdynamics, Elemental Calculus (A,B, I,II), Linear Algebra (A,B)

[Evaluation methods and policy]

By the final exam., in principle.

[Textbooks]

H. M. Liepmann and A. Roshko 『Elements of Gasdynamics』（Dover Publications）ISBN:0486419630

[References, etc.]

（**Reference books**）

J. D. Anderson, Jr. 『Modern Compressible Flow (2nd ed.)』（McGraw-Hill）ISBN:0071006656

[Study outside of class (preparation and review)]

Students are expected to read the textbook by themselves in accordance with the progress of the class.

（Other information (office hours, etc.)）

Actual times and order of topics may change, depending on the class attendants or other reasons.

*Please visit KULASIS to find out about office hours.

熱統計力学（宇）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35048 LJ77		
Course title (and course title in English)	推進基礎論（宇） Fundamentals of Aeroapace Propulsion	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,ERIGUCHI KOUJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Propulsion Fundamentals,1time,
,3times,
Ionized Gases,1time,
Electromagnetics,2times,
Equation of Ionized Gases,1time,
Atomic and Molecular Collisions,2times,
Diffusion and Transport of Ionized Gases,1time,
Ionized Gases near Solid Surfaces,2times,
Electric Propulsion,1time,
,1time,

[Course requirements]

Fluid Dynamics, Gas Dynamics, Thermodynamics, Electromagnetics

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

R.W. Humble, G.N. Henry, and W.J. Larson, Space Propulsion Analysis and Design (McGraw-Hill, New York, 1995)
G.P. Sutton and O. Biblarz, Rocket Propulsion Elements, 8th ed. (John Wiley amp Sons, Hoboken, 2010)

Continue to 推進基礎論（宇）(2)↓↓↓

isbn{}{9780470080245};
G.P. Sutton and O. Biblarz, Rocket Propulsion Elements, 7th ed. (Wiley, New York, 2001) isbn{}{0471326429};
M. Mitchner and Ch.H. Kruger, Jr., Partially Ionized Gases (Wiley, New York, 1973) isbn{}{0471611727};
F.F. Chen, Introduction to Plasma Physics and Controlled Fusion, 3rd ed. (Springer International Publishing Switzerland, Cham, 2016) isbn{}{9783319223087};
F.F. Chen, Introduction to Plasma Physics and Controlled Fusion, Vol. 1, Plasma Physics, 2nd ed. (Plenum, New York, 1984) isbn{}{9780306413322};
L.M. Biberman, V.S. Vorobev, and I.T. Yakubov, Kinetics of Nonequilibrium Low-Temperature Plasmas (Consultants Bureau, New York, 1987);
R.O. Dendy ed., Plasma Physics: An Introductory Course (Cambridge University Press, London, 1993) isbn{}{0521433096}, (同, 1995) isbn{}{0521484529};
M.A. Lieberman and A.J. Lichtenberg, Principles of Plasma Discharges and Materials Processing (Wiley-Interscience, Hoboken, 2005) isbn{}{0471720011}.

[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

[Evaluation methods and policy]

Evaluation depends on marks of examination and exercises.

[Textbooks]

Instructed during class

[References, etc.]

（**Reference books**）
L. D. Landau and E. M. Lifshitz 『Mechanics, Volume 1 (Course of Theoretical Physics) 』（Elsevier）ISBN:0750628960
Herbert Goldstein 『Classical Mechanics』（Addison-Wesley）ISBN:0201657023（international ed. ISBN 0321188977）
Toda 『Introductory course of physics 1 Mechanics』（Iwanami Shoten）ISBN:4000076418（in Japanese）

Koide 『Introductory course of physics 2 Analytical Mechanics 』（Iwanami Shoten）ISBN:4000076426（in Japanese）
Wadachi 『Introductory course of physics 10 Mathematics for physics』（Iwanami Shoten）ISBN:4000076507（in Japanese）

[Study outside of class (preparation and review)]

Learn the basic mechanics and mathematics for analytical mechanics.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 35049 LJ77		
Course title (and course title in English)	航空宇宙機力学（宇） Flight Dynamics of Aerospace Vehicle	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,AOI SHINYA Graduate School of Engineering Professor,SENDA KEI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Flight dynamics of aerospace vehicles.

[Course objectives]

To understand analytical mechanics through flight dynamics of aerospace vehicles.

[Course schedule and contents]

Analytical mechanics, 7 times
- introduction
- coordinates
- principle of virtual work
- d'Alembert principle
- potential
- Lagrange equation of motion
- conservation law
- Lagrange multiplier
- Euler-Lagrange equation

Rigid body kinematics, 3 times
- Euler angles
- angular rate
- pseudo coordinates

Rigid body dynamics, 3 times
- kinetic energy of rigid body
- linear and angular momentum
- inertia tensor
- Euler equation of motion

Dynamics of space vehicle, 2 times
- topics of attitude dynamics of space vehicles

Achievement confirmation, 1 time
- achievement confirmation to check up level of understanding

[Course requirements]

Foundation of mechanics and mathematics

Continue to 航空宇宙機力学（宇）(2)↓↓↓

Course number	U-ENG25 35051 LJ71		
Course title (and course title in English)	固体力学（宇） Mechanics of Solids	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,BIWA SHIROU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

While the methods of stress-strain analysis for elementary structural members are the main topics in the "Mechanics of Materials" courses, more general physical laws of the mechanical behavior of solids are dealt with in this course. Namely, fundamental principles of solid mechanics such as three-dimensional expressions of stress and strain, equilibrium equations, constitutive equations (Hooke's law) are treated together with mathematical analysis of static deformations in elastic bodies. These subjects are important for the understanding of basic principles of large-scale computational analysis of various mechanical/structural systems.

[Course objectives]

This course aims to establish the understanding of rigorous expressions of stress and strain and fundamentals of deformation analysis of solids and structures. It is also the aim of this course to re-examine the values of approximate theories given in the "Mechanics of Materials" courses from a rigorous viewpoint.

[Course schedule and contents]

The following topics are discussed in the lectures, but subject to possible change according to each year's situations.
Week 1 [Preliminaries] Basis vecotrs; Kronecker's delta; Alternating symbol; Summation convention
Weeks 2-3 [Deformation and strain] Description of motion; Material time derivative; Green-Lagrange strain; Infinitesimal strain; Transformation of strain components; Principal strains
Weeks 4-6 [Stress and laws of motion] Stress vector, Euler's laws of motion; Cauchy's law; Transformation of stress components; Cauchy's laws of motion; Equilibrium equations; Principal stresses and stress invariants
Week 7-8 [Stress-strain relations] Hooke's law; Elastic moduli; Voigt expression
Weeks 9-10 [Fundamental equations of elasticity] Navier's equations; Plane stress and plane strain; Compatibility relation for strain
Weeks 11-13 [Two-dimensional problems of elastic deformations] Airy's stress function; Biharmonic equation; Stress function in polar coordinates; Stress concentration around a circular hole; Stress function for torsion; Torsion of bars of elliptic cross-sections
Weeks 14 [Principle of virtual work] Virtual displacement; Principle of virtual work; Principle of stationary potential energy
Week 15 [Final examination/learning achievement evaluation]
Week 16 [Feedback]

Continue to 固体力学（宇）(2)↓↓↓

固体力学（宇）(2)

[Course requirements]

The enrolling students are expected to have knowledge in the Mechanics of Materials courses. Good understanding of calculus, linear algebra (eigenvalue problems) and vector analysis is also necessary.

[Evaluation methods and policy]

Grading is made based on the examination (85%) and the reports (15%). The total score of the examination and the reports is evaluated between 0 and 100 points (the pass mark is 60).

[Textbooks]

Textbooks are not assigned. The lecture is given in the blackboard style.

[References, etc.]

（**Reference books**）
T. Inoue, "Fundamentals of elasticity" (Nikkan Kogyo)
S. Kobayashi and K. Kondo, "Elasticity" (Baihu-kan)
For references written in English, students are advised to contact the instructor directly.

[Study outside of class (preparation and review)]

Contents of "Mechanics of Materials" courses should be fully reviewed. Homeworks (reports) will be assigned to review the lectures.

（Other information (office hours, etc.)）

Lectures are given in a black-board style. Students are expected to take the notes to understand the ideas and mathematical derivations, and make questions regarding unclear points.

*Please visit KULASIS to find out about office hours.

物理工学演習 1（エネ）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35054 SJ77　U-ENG25 35054 SJ71		
Course title (and course title in English)	物理工学演習 1（エネ） Exercise on Engineering Science 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,ISHIYAMA TAKUJI
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/First semester		
Days and periods	Mon.4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,9times,
,6times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 物理工学演習 1（エネ）(2)↓↓↓

未更新

Course number	U-ENG25 35054 SJ77　U-ENG25 35054 SJ71		
Course title (and course title in English)	物理工学演習 1（原） Exercise on Engineering Science 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,OGURE KENZOU Graduate School of Engineering Associate Professor,MIYADERA TAKAYUKI
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/First semester		
Days and periods	Tue.3,4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Linear algebra,5times,
Linear differential equations,5times,
Laplace transform,4times,
Confirmation of achievement in study,1time,

[Course requirements]

differential and integral, linear algebra

[Evaluation methods and policy]

exercises and reports

[Textbooks]

Prints are distributed in the class.

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35054 SJ77　U-ENG25 35054 SJ71		
Course title (and course title in English)	物理工学演習１（宇） Exercise on Engineering Science 1	Instructor's name, job title, and department of affiliation	Part-time Lecturer,TAKAHASHI KENICHI Part-time Lecturer, Part-time Lecturer,
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/First semester		
Days and periods	Thu.3,4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,5?6times,
,5?6times,
,2times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

物理工学演習２（エネ）(2)

[Textbooks]

Handout will be provided in each topic.

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Students are supposed to study the contents of each topic before the course.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 35055 SJ77　U-ENG25 35055 SJ71		
Course title (and course title in English)	物理工学演習２（エネ） Exercise on Engineering Science 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,ISHIHARA KEIICHI Graduate School of Energy Science Professor,ISHIYAMA TAKUJI Graduate School of Energy Science Professor,KAWANABE HIROSHI Graduate School of Energy Science Professor,KASHIWAYA YOSHIAKI Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Energy Science Associate Professor,MATSUMOTO KAZUHIKO
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

Exercises for each topic related to energy science will be provided during lecture, and students are supposed to solve them and submit assignments. Answers and commenets including related fields will also be provided.

[Course objectives]

This class aims to help students to learn fundamental matters in the field of energy science acquire by solving exercises.

[Course schedule and contents]

Thermal engineering, 3 weeks
Hydrodynamics, 3 weeks
Mechanics of materials. 2 weeks
Thermodynamics, 2 weeks
Physical Chemistry, 2 weeks
Crystallography, 2 weeks
Summary, 1 week

[Course requirements]

It is desirable that students learned the basis of each topic.

[Evaluation methods and policy]

Evaluation will be based on active participation and assignments.

Continue to 物理工学演習２（エネ）(2)↓↓↓

未更新

Course number	U-ENG25 35055 SJ77　U-ENG25 35055 SJ71		
Course title (and course title in English)	物理工学演習２（原） Exercise on Engineering Science 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Professor,YOKOMINE TAKEHIKO Graduate School of Engineering Assistant Professor,OGURE KENZOU
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Second semester		
Days and periods	Tue.4,5	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,4times,
,5times,
,5times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35055 SJ77　U-ENG25 35055 SJ71		
Course title (and course title in English)	物理工学演習２（宇） Exercise on Engineering Science 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Part-time Lecturer,YAGI DAISUKE

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/Second semester
Days and periods	Fri.3,4	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

Conduct lecture and exercise on aircraft and spacecraft design.

[Course objectives]

Understand the basis of aircraft/spacecraft systems and flight dynamics, and acquire a basic attitude toward aircraft/spacecraft design.

[Course schedule and contents]

1. History of aircraft and spacecraft [1 week]
   History of aircraft development and effort in Japan
   History of spacecraft development and effort in Japan
2. Spacecraft - Summary of satellite and rocket systems [1 week]
   Summary of satellite system
   Summary of rocket system
   Summary of propulsion system of spacecraft
3. Spacecraft - Orbit of satellite [1 week]
   Kepler motion
   Transfer of orbit
4. Spacecraft - Principle of rocket propulsion [1 or 2 weeks]
   Thrust and effective exhaust velocity
   Specific impulse
   Ideal velocity and mass component
   Multi-stage rocket
   Required velocity increment
5. Spacecraft - Design exercise [1 or 2 weeks]
   Exercise on sizing of rocket specification
6. Aircraft - Summary of airplane system [1 week]
   Airplane shape
   Airplane structure
   Airplane subsystems
   Airplane engine
7. Aircraft - Airplane performance [2 or 3 weeks]
   Standard atmosphere
   Definition of velocity
   Aerodynamic characteristics
   Engine performance
   Major performances of airplane

Continue to 物理工学演習２（宇）(2)↓↓↓

Course number	U-ENG25 35056 EJ71		
Course title (and course title in English)	機械システム工学実験１（機） Mechanical and System Engineering Laboratory 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Assistant Professor,SAITOU MOTOHIRO Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Professor,INOUE YASUHIRO Graduate School of Engineering Assistant Professor,FUJII KEISUKE Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Assistant Professor,WAKABAYASHI HIDENOBU

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/First semester
Days and periods	Wed.4,5	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

Continue to 機械システム工学実験１（機）(2)↓↓↓

8. Aircraft - Airplane stability and controllability [1 week]
   Longitudinal stability and controllability
   Center of gravity limits
   Lateral and directional stability and controllability
   Crosswind landing
   Trim at engine failure
9. Aircraft - Airplane airworthiness [1 week]
   Regulation of airplane airworthiness
   Lessons learned from accidents
10. Aircraft - Design exercise [1 or 2 weeks]
    Exercise on flight test of airplane

* As part of the class, students may take a tour of facilities outside the university related to aircraft/spacecraft.

[Course requirements]

Assumes students understand the fundamentals of dynamics.

[Evaluation methods and policy]

[Evaluation method]
Evaluation will be based on report (75%) and class performance (25%).
Evaluation for class performance includes the attendance at the class and the effort toward the exercise.
[Evaluation policy]
Evaluate the degree of understanding of aircraft/spacecraft systems and flight dynamics, and the degree of mastery of basic attitude toward aircraft/spacecraft design.

[Textbooks]

Handouts will be distributed.

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Students are likely to make reports outside of class time, which will be imposed during class.

（Other information (office hours, etc.)）

The contents and number of classes are subject to change depending on the situation.

*Please visit KULASIS to find out about office hours.

[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.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35056 EJ71		
Course title (and course title in English)	機械システム工学実験１（機） Mechanical and System Engineering Laboratory 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Assistant Professor,SAITOU MOTOHIRO Graduate School of Engineering Assistant Professor,FUJII KEISUKE Graduate School of Engineering Assistant Professor,WAKABAYASHI HIDENOBU Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Engineering Professor,INOUE YASUHIRO
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Second semester		
Days and periods	Mon.4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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]

None

Continue to 機械システム工学実験１（機）(2)↓↓↓

未更新

Course number	U-ENG25 35057 EJ71		
Course title (and course title in English)	機械システム工学実験２（機） Mechanical and System Engineering Laboratory 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,WAKABAYASHI HIDENOBU Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Assistant Professor,OKINO SHINYA Graduate School of Engineering Assistant Professor,hirai yoshikazu Institute for Frontier Life and Medical Sciences Assistant Professor,KAMEO YOSHITAKA Graduate School of Engineering Associate Professor,MATSUMOTO MITSUHIRO Graduate School of Engineering Associate Professor,KOUNO DAISUKE Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Assistant Professor,TERAKAWA　TATSURO Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/First semester		
Days and periods	Thu.4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

Continue to 機械システム工学実験２（機）(2)↓↓↓

機械システム工学実験１（機）(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.

[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

機械システム工学実験２（機）(2)

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35057 EJ71		
Course title (and course title in English)	機械システム工学実験２（機） Mechanical and System Engineering Laboratory 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,WAKABAYASHI HIDENOBU Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Assistant Professor,OKINO SHINYA Graduate School of Engineering Assistant Professor,hirai yoshikazu Institute for Frontier Life and Medical Sciences Assistant Professor,KAMEO YOSHITAKA Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Engineering Assistant Professor,TERAKAWA　TATSURO Graduate School of Engineering Associate Professor,KOUNO DAISUKE Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Graduate School of Engineering Associate Professor,MATSUMOTO MITSUHIRO

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/Second semester
Days and periods	Thu.1,2	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[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.

Continue to 機械システム工学実験２（機）(2)↓↓↓

未更新

Course number	U-ENG25 35058 EJ71		
Course title (and course title in English)	機械システム工学実験３（機） Mechanical and System Engineering Laboratory 3	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Assistant Professor,MATSUDA NAOKI Graduate School of Engineering Assistant Professor,ＮＡＭＵＲＡ　ＫＹＯＫＯ Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Informatics Assistant Professor,HOSHINO　KENTA Graduate School of Engineering Senior Lecturer,SENAMI MASATO

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/First semester
Days and periods	Fri.4,5	Class style	Experiment	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,14times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 機械システム工学実験３（機）(2)↓↓↓

機械システム工学実験２（機）**(2)**

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[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

機械システム工学実験３（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 35058 EJ71		
Course title (and course title in English)	機械システム工学実験３（機） Mechanical and System Engineering Laboratory 3	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Assistant Professor,MATSUDA NAOKI Graduate School of Engineering Assistant Professor,ＮＡＭＵＲＡ　ＫＹＯＫＯ Graduate School of Informatics Assistant Professor,HOSHINO　KENTA Graduate School of Engineering Associate Professor,SHIMADA TAKAHIRO Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Engineering Senior Lecturer,SENAMI MASATO
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Second semester		
Days and periods	Thu.4,5	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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]

None

Continue to 機械システム工学実験３（機）(2)↓↓↓

未更新

Course number	U-ENG25 35059 SJ71		
Course title (and course title in English)	機械設計演習１（機） Exercise of Machine Design 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI Graduate School of Engineering Associate Professor,NAKAJIMA KAORU Graduate School of Engineering Professor,YOKOKAWA RYUUJI Part-time Lecturer,KANEDA SHUICHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.4,5,Fri.4,5	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,4times,
,3times,
,-times,
,21times,
,21times,
,21times,
,2times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 機械設計演習１（機）(2)↓↓↓

機械システム工学実験３（機）(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.

[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

機械設計演習１（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 35059 SJ71		
Course title (and course title in English)	機械設計演習 1 （機） Exercise of Machine Design 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI Graduate School of Engineering Associate Professor,SHIKAMA TAIICHI Graduate School of Engineering Associate Professor,TATSUMI KAZUYA Part-time Lecturer,YAMANAKA KOUSUKE
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.4,5,Thu.4,5	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 機械設計演習 1 （機） (2)↓↓↓

未更新

Course number	U-ENG25 35059 SJ71		
Course title (and course title in English)	機械設計演習 1 （機） Exercise of Machine Design 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI Graduate School of Engineering Associate Professor,SUMIGAWA TAKASHI Graduate School of Engineering Associate Professor,MATSUMOTO MITSUHIRO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.4,5,Fri.4,5	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 機械設計演習 1 （機） (2)↓↓↓

機械設計演習 1 （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
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

機械設計演習 1 （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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 35060 SJ71		
Course title (and course title in English)	機械設計演習２（機） Exercise of Machine Design 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KOMORI MASAHARU Graduate School of Engineering Professor,HIRAYAMA TOMOKO Graduate School of Engineering Associate Professor,KOUNO DAISUKE Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Part-time Lecturer,KANEDA SHUICHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.1,2,3,4	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,14times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 機械設計演習２（機）(2)↓↓↓

未更新

Course number	U-ENG25 25061 PJ71		
Course title (and course title in English)	機械製作実習（機） Exercise for Machine Shop Practice	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Associate Professor,KOUNO DAISUKE Graduate School of Engineering Professor,NAKABE KAZUYOSHI Graduate School of Engineering Professor,NISHIWAKI SHINJI Part-time Lecturer,Part-time Lecturer

Target year	2nd year students or above	Number of credits	1	Year/semesters	2020/Second semester
Days and periods	Wed.5	Class style	Practical training	Language of instruction	Japanese

[Overview and purpose of the course]

This course consists of two parts: machine shop training and special lectures by visiting lecturers. The machine shop training will be offered for a week in August or September (during summer break). Students will learn the operation of various machine tools, e.g. a lathe, a milling machine, and a drilling machine, to make a stirling engine, whose performance will be tested at the end of the course. Hands-on training of disassembly and re-assembly of a commercial diesel engine (or a gasoline engine) will be also offered to learn actual engine mechanism.
The seminar series will be offered in the 2nd semester. Professional engineers from various companies will be invited to give a lecture on real-world experience on production design, manufacturing, or management.

[Course objectives]

To experience turning, milling and drilling operations and other basic machining operations. To obtain basic knowledge and experience on machine tools, cutting tools, measurement, and machining accuracy by hands-on training.

[Course schedule and contents]

Lectures on principle of engines,1time,Students will learn basic knowledge on the priciple of a stirling engine and a diesel (gasoline) engine.
Lectures on machine tools ,1time,Students will learn basic knowledge on machine tools that they will use in machine shop training.
Machine shop training (making a stirling engine),4times,Turning operation for cylindrical parts (2 classes), milling and drilling operations (2 classes), assembly and evaluation (1 class). A group of two students will make one stirling engine.
Disassembly of an engine,1time,Assebly and disassembly of a commercial diesel (or gasoline) engine.
Lectures on safety,1time,A special lecture on safety issues in manufacturing process and product design by a visiting lecturer.
Special seminars,7times,Special seminars by visiting lecturers. Lectures may be subject to change each year. Examples of past lectures:\ quotTo future Edison -- save the world by good idea and engineering,quot\ quotDevelopment of compressors to meet market#039s needs -- role of mechanical engineers,quot\ quotJapanese machine tools for the world#039s manufacturing - key technologies,quot\ quotEngineer#039s life in companies.quot
Factory tour,1time,One-day trip to a factory in Kansai area.

Continue to 機械製作実習（機）(2)↓↓↓

機械設計演習２（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
A course with practical content delivered by instructors with practical work experience

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

機械製作実習（機）**(2)**

[Course requirements]

None.

[Evaluation methods and policy]

For the credit, students are in principle required to participate in all the classes, and to submit all the reports.

[Textbooks]

A textbook will be handed out in class.

[References, etc.]

（**Reference books**）
None.

（**Related URLs**）
(None.)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

The class overview will be presented in a guidance class for 2nd year students in Undergraduate Course Program of Mechanical and Systems Engineering in April. Detailed schedule will be given then.
Please be aware -- a large part of this class will be offered during the summer break.
A class guidance will be given typically in July. Its announcement will be posted in the 1st floor of the building of Dept. of Engineering Science. All the students who want to take this class must come to this guidance.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

未更新

Course number	U-ENG25 35062 SJ75		
Course title (and course title in English)	材料科学実験および演習１（材） Materials Science Laboratory and Exercise 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Associate Professor,YUGE KORETAKA
Target year	3rd year students or above	Number of credits	3
Year/semesters	2020/First semester		
Days and periods	Wed.3,4,Thu.3,4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,6times,
,6times,
,6times,
,6times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35066 EJ77		
Course title (and course title in English)	航空宇宙工学実験１（宇） Engineering Laboratory in Aeronautics and Astronautics 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,SUGIYAMA FUMIKO Graduate School of Engineering Assistant Professor,HATTORI MASANARI Graduate School of Engineering Professor,TAKATA SHIGERU Graduate School of Engineering Assistant Professor,NODA RYUSUKE
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/First semester		
Days and periods	Fri.3,4	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,4times,
,4times,
,4times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 航空宇宙工学実験１（宇）(2)↓↓↓

未更新

Course number	U-ENG25 35063 SJ75		
Course title (and course title in English)	材料科学実験および演習２（材） Materials Science Laboratory and Exercise 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Associate Professor,YUGE KORETAKA
Target year	3rd year students or above	Number of credits	3
Year/semesters	2020/Second semester		
Days and periods	Wed.3,4,Thu.3,4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,6times,
,6times,
,6times,
,6times,

[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.

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35067 EJ77		
Course title (and course title in English)	航空宇宙工学実験２（宇） Engineering Laboratory in Aeronautics and Astronautics 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,URABE KEIICHIRO Graduate School of Engineering Associate Professor,MARUTA ICHIROU Graduate School of Engineering Assistant Professor,SUGIYAMA FUMIKO Graduate School of Engineering Professor,TAKATA SHIGERU Graduate School of Engineering Senior Lecturer,SUGIMOTO HIROSHI
Target year	3rd year students or above	Number of credits	1
Year/semesters	2020/Second semester		
Days and periods	Tue.3,4	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,4times,
,4times,
,4times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 航空宇宙工学実験２（宇）(2)↓↓↓

未更新

Course number	U-ENG25 35069 LJ75		
Course title (and course title in English)	金属材料学（材） Structural Metalic Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUJI NOBUHIRO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Outline of Lecture,1time,
Microstructure Evolution in Cast Alloys,2times,
Deformation, Recovery, Recrystallization and Grain Growth,3times,
,3times,
Heat Treatment in Steels,5times,
Summary,1time,

[Course requirements]

None

[Evaluation methods and policy]

Attendance, exercises, home-works and exam.

[Textbooks]

[References, etc.]

（**Reference books**）

（**Related URLs**）

(http://www.tsujilab.mtl.kyoto-u.ac.jp/01TsujiLab/Education/StructMetalMater/)

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

航空宇宙工学実験２（宇）(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

未更新

Course number	U-ENG25 35070 LJ75		
Course title (and course title in English)	材料強度物性（材） Physics of Strength of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,INUI HARUYUKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course explaines fundamentals of crystal plasticity and strength of materials including plastic deformation of crystals, yielding, work-hardening, solution hardening, precipitation hardening, properties of grain boundaries, based on dislocation theory.

[Course objectives]

This class aims to help students to acquire fundamentals of deformation of crystalline materials and also to acquire ways to interpret strength of crystalline materials based on dislocation theory.

[Course schedule and contents]

(1) Yielding in crystalline materials [2 weeks]
(2) Work hardening, solution hardening and precipitation hardening [3 weeks]
(3) Strength and toughness of composites [1 week]
(4) Dislocations in crystalline materials [6 weeks]
(5) Dislocation motions and thermal activation processes [1 week]
(6) Grain boundaies and crystal plasticity of polycrystals [1 week]
(7) Feedback [1 week]

[Course requirements]

Physics of Crystal Properties and Imperfections

[Evaluation methods and policy]

Evaluation will be based on a written examination. Attendance and daily reports may be considered in grading determination.

[Textbooks]

Hand out materials will be provided during the lecture.

[References, etc.]

（**Reference books**）
鈴木秀次『転位論入門』（アグネ）ISBN:4750702315
J.P. Hirth and J. Lothe『Theory of Dislocations』（McGraw-Hill）ISBN:TY86299777
J.P. Hirth and J. Lothe『Theory of Dislocations, 2nd ed.』（Wiley）ISBN:047109125
角野浩二(編)『結晶の塑性』（丸善）ISBN:TW86162567
日本金属学会『材料強度の原子論』（日本金属学会）ISBN:4889030220

Continue to 材料強度物性（材）(2)↓↓↓

材料強度物性（材）(2)

竹内　伸『結晶塑性論』（内田老鶴圃）ISBN:978-4-7536-5090-3

[Study outside of class (preparation and review)]

To review contents covered in the previous lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45073 LJ75　U-ENG25 45073 LJ57　U-ENG25 45073 LJ71		
Course title (and course title in English)	統計熱力学 Statistical Thermodynamics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,MATSUMOTO MITSUHIRO
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Statistical mechanics provides a firm foundation for thermodynamics. I'll give a standard course of statistical mechanics through several basic examples in various fields of science and engineering, including quantum mechanics, solid state physics, heat transfer engineering, and information technology.

[Course objectives]

- Understanding the relation between macroscopic variables and microscopic states.
- Scientific view of various phenomena in science and engineering based on statistics.

[Course schedule and contents]

1st week: Concepts of statistical physics and Review of basic statistics
2nd week: Counting microscopic states
3rd week: Microcanonical ensemble
4th-6th weeks: Various ensembles and Free energies
7th-9th weeks: Quantum statistics (Bose-Einstein vs. Fermi-Dirac)
10th-11th weeks: Introduction to solid state physics
12th week: Photons and Phonons
13th week: Application to Informatics
14th week: Examination
15th week: Feedback class

[Course requirements]

Basic knowledge of thermodynamics, calculus, statistics, analytical mechanics, and quantum physics will be useful.

[Evaluation methods and policy]

- Written examination
- Paper assignment

[Textbooks]

Lecture notes will be provided.

[References, etc.]

（**Reference books**）
Introduced during class

Continue to 統計熱力学(2)↓↓↓

未更新

Course number	U-ENG25 45071 LJ71		
Course title (and course title in English)	固体物性学（機） Physics of Solids	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NAKAJIMA KAORU
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Crystal structure,1time,
Diffraction of waves by crystals,3~4times,
Vibrations of crystals,3~4times,
Thermal properties of crystals,2times,
Electronic dtructures of crystals,3~4times,
Assessment of achievement,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）
quotIntroduction to solid state physicsquot by Charles Kittel isbn{}{9780471415268}, international ed. isbn{}{0471680575}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

統計熱力学(2)

[Study outside of class (preparation and review)]

Since this class covers basics in physics with many examples encountered in science and engineering, students of various research fields are welcome.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45073 LJ75　U-ENG25 45073 LJ57　U-ENG25 45073 LJ71		
Course title (and course title in English)	統計熱力学（材エネ） Statistical Thermodynamics	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,MIYAKE MASAO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

In this lecture, fundamental ideas of Statistical Thermodynamics which is effective to microscopic understanding of macroscopic systems and some typical applications to condensed matter physics are presentaed.

[Course objectives]

The goals of this lecture are both to understand fundamental idead of Statistical Thermodynamics and to study typical applications to condensed matter physics.

[Course schedule and contents]

Outlines,1time,Basic ideas of Statistical Thermodynamics, thermal equilibrium, fundamentals of Statistics, means of measuremnts, ergodic theory.
Themodynamic functions,1time,Thermodynamic laws, thermodynamic functions, Legendre transform, Maxwell relations, Gibbs-Helmholtz equation, thermodynamic variation, phase equilibrium.
Ideal systems,4times,Phase space of movement, Liouville#039s theorem, micro canonical ensemble,Partition function, relation between Helmholtz free energy and Partition function,Principle of Boltzmann, simple applications of microcanonical ensamble (ideal gas, elastic of gum)
,1time,
Canonical ensemble,2times,Distribution with the maximum probability, Partition function, the 3rd law of thermodynamics, Gibbs#039s paradox, grand canonical ensamble.
Quantum statistics,2times,Grad canonical ensamble of quatum statistics, Fermion and Boson, Bose-Einstein statistics, Fermi-Dirac statistics,ideal Fermi gas, electron specific heat, ideal Bose gas, Bose-Einstein condensation.
Typical applications,4times,Systems with two levels, Schottly type specific heat, Statistics of photons, Planck#039s equation, one dimansional harmonic oscillation, Einstein model and specific heat of solid states.
Evaluation od goals,1time,Understanging of typical applications of statistic themodynamics and submission of homeworks.

[Course requirements]

Students are roughly expected to have mastered basics of mathematics, dynamics, elementary quantum mechanics, thermodynamics and statistics.

Continue to 統計熱力学（材エネ）(2)↓↓↓

未更新

Course number	U-ENG25 45087 LJ71		
Course title (and course title in English)	品質管理 Quality Control	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI Graduate School of Engineering Associate Professor,IZUI KAZUHIRO

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course deals with the basics of quality control methodologies and reliability engineering techniques.

[Course objectives]

The goal is to understand the concept of numerical and strategic approaches of quality control techniques.

[Course schedule and contents]

Introduction,1time,
Statistics and hypothesis testing,2times,
Statistical process control,2times,
Design of experiments,2times,
Analysis of variance,2times,
Application of design of experiments,2times,
Reliability,4times,

[Course requirements]

None

[Evaluation methods and policy]

The regular examination, in-class examinations and reports are taken into account.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Homework problems are assigned.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Evaluation methods and policy]

Situation of voluntary submission of some reports and score of exam are totally evaluated.

[Textbooks]

The textbook is not appointed. Writing on the blackboard is performed in every lecture.

[References, etc.]

（**Reference books**）

1．原島　鮮：「熱力学・統計力学」培風館， isbn{}{9784563021399}
2．N.スミス（小林宏・岩橋槇夫訳）：「統計熱力学入門ー演習によるアプローチー」東京化学同人， isbn{}{4807903225}
3．市村　浩：「統計力学」裳華房， isbn{}{4785321342}
4．市村　浩：「熱学演習ー統計力学」裳華房， isbn{}{4785321350}
5．キッテル：「熱物理学」丸善， isbn{}{9784621027271}
6．沼居貴陽：「熱物理学・統計物理学演習」丸善， isbn{}{4621048570}
7・W.グライナー，L.ナイゼ，H.シュテッカー（伊藤伸泰，青木圭子訳）：「熱力学・統計力学」シュプリンガー， isbn{}{9784431100577}
8．久保亮五：「ゴム弾性」裳華房 isbn{}{478532807X}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

2nd year students may undestand this lecture if they catch on basics of physics.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35096 LJ57　U-ENG25 35096 LJ68		
Course title (and course title in English)	生物物理学 Molecular Biophysics	Instructor's name, job title, and department of affiliation	Graduate School of Biostudies Professor,MATSUMOTO TOMOHIRO Institute for Integrated Radiation and Nuclear Science Associate Professor,SAKURAI YOSHINORI Graduate School of Biostudies Professor,TAKATA MINORU Graduate School of Biostudies Professor,HARADA HIROSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Continue to 生物物理学(2)↓↓↓

生物物理学(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.

精密加工学（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 45099 LJ71		
Course title (and course title in English)	精密加工学（機） Precision Machining	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Associate Professor,KOUNO DAISUKE
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 精密加工学（機）(2)↓↓↓

Course number	U-ENG25 35102 LJ75		
Course title (and course title in English)	材料電気化学（材） Electrochemistry of Materials Processing	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MURASE KUNIAKI Graduate School of Engineering Associate Professor,FUKAMI KAZUHIRO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course serves the fundamentals related to solution chemistry of electrolytes and electrode reactions, which become the basis of wet processing such as electrolytic refining, electrowinning, corrosion, anticorrosion, and functional electrodeposition.

[Course objectives]

In this course students learn basic technical terms and basic concepts of physical chemistry, which are necessary to study materials science and engineering from the viewpoints of solution chemistry and electrochemistry, to take subsequent advanced courses on materials science and engineering.

[Course schedule and contents]

Overview 1 time

Solution chemistry of electrolytes, 2 times, acid-base reactions, redox reactions, equilibrium of them.

Introduction of electrode potential and its relation to chemical thermodynamics, 4 times, explanation of electrode surface as an interface for exchange the carrier, explanation of the concept of electrode potential and Nernst's equation.

Electrolysis, 1 time, explanation on the importance of three electrode setup (working, counter and reference electrodes).

Electrode reactions, 4 times, explanation on the fundamentals of electrochemical reaction rate on a electrode surface toward understanding of batteries and corrosion, explanation on the relation between current and potential, overpotential, diffusion-limitation of reactants.

Transfer of ions, 2 times, explanation on the transfer of ions in solution for understanding diffusion potential and liquid junction potential.

Summary, 1 time.

[Course requirements]

Knowledge given in Thermodynamics of Materials 2 (by Prof. Uda) is preferable.

Continue to 材料電気化学（材）(2)↓↓↓

材料電気化学（材）(2)

[Evaluation methods and policy]

(1) Class participation, (2) take-home assignments, and (3) exams. Students will sign a roll sheet every class. Supplementary examination to bail out low-performing students will not be given for any reason.

[Textbooks]

A course booklet written in Japanese will be given out at the first lecture.

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

Reports given in the lectures will return after checking.
Brush up according to the reports returned.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

原子炉基礎演習・実験（原）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

1) Registration to workers for radioactive material treatment is required before experiment.
2) English course for this experiment is opened.

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 45107 SJ28　U-ENG25 45107 SJ77　U-ENG25 45107 SJ57		
Course title (and course title in English)	原子炉基礎演習・実験（原） Basic Nuclear Reactor Exercise and Experiments	Instructor's name, job title, and department of affiliation	Institute for Integrated Radiation and Nuclear Science Professor,UNESAKI HIRONOBU Institute for Integrated Radiation and Nuclear Science Professor,MISAWA TSUYOSHI Institute for Integrated Radiation and Nuclear Science Professor,NAKAJIMA KEN Graduate School of Energy Science Associate Professor,PIYON CHIYORUHO
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.3,4	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

Basic reactor physics experiments using Kyoto University Critical Assembly (KUCA) which is a small and low power reactor are carried out. Guidance and lectures before experiments are perfomed at Yoshida main campus, and experiments are perfomed at Research Reactor Institute (Osaka Kumatori-cho).

[Course objectives]

Understanding nuclear characteristics and safety system of nuclear reactor through reactor physics experiments

[Course schedule and contents]

Guidance,6times,Guidance and lectures for experiments are performed at Yoshida main campus.
Experiment,1time,Experiments are performed at Research Reactor Institute (Kumatori-cho, Osaka) for 1 week. 1) guidance 2) criticality approarch experiment 3) control rod caribration experiment 4) neutron flux measurement experiment 5) operation of nuclear reactor

[Course requirements]

Basic knowledge about reactor physic

[Evaluation methods and policy]

reports before and after experiments

[Textbooks]

Download from Web site (Japanese, English and Korean versions are available)

[References, etc.]

（Reference books）

Continue to 原子炉基礎演習・実験（原）(2)↓↓↓

未更新

Course number	U-ENG25 15110 LJ71　U-ENG25 15110 LJ77		
Course title (and course title in English)	物理工学総論Ａ（7・8・9組） Introduction to Engineering Science A	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HOUJIYOU MASAKI Graduate School of Engineering Associate Professor,NISHIKAWA MASAAKI Graduate School of Engineering Professor,IWAI HIROSHI Graduate School of Engineering Professor,KUROSE RYOUICHI Graduate School of Engineering Professor,MATSUNO FUMITOSHI Graduate School of Engineering Professor,MATSUBARA ATSUSHI Institute for Frontier Life and Medical Sciences Professor,ADACHI TAIJI Institute for Frontier Life and Medical Sciences Senior Lecturer,OKEYO, Kennedy Omondi Graduate School of Engineering Professor,SUZUKI MOTOFUMI Graduate School of Engineering Professor,HASUO MASAHIRO Graduate School of Engineering Professor,SENDA KEI
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,10times,
,4times,
,1time,

[Course requirements]

None

Continue to 物理工学総論Ａ（7・8・9組）(2)↓↓↓

物理工学総論Ａ（7・8・9組）(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.

物理工学総論Ａ（9・10・11・12組）(2)

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 15110 LJ71　U-ENG25 15110 LJ77		
Course title (and course title in English)	物理工学総論Ａ（9・10・11・12組） Introduction to Engineering Science A	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HOUJIYOU MASAKI Graduate School of Engineering Associate Professor,NISHIKAWA MASAAKI Graduate School of Engineering Professor,IWAI HIROSHI Graduate School of Engineering Professor,KUROSE RYOUICHI Graduate School of Engineering Professor,MATSUNO FUMITOSHI Graduate School of Engineering Professor,MATSUBARA ATSUSHI Institute for Frontier Life and Medical Sciences Professor,ADACHI TAIJI Institute for Frontier Life and Medical Sciences Senior Lecturer,OKEYO, Kennedy Omondi Graduate School of Engineering Professor,SUZUKI MOTOFUMI Graduate School of Engineering Professor,HASUO MASAHIRO Graduate School of Engineering Professor,SENDA KEI

Target year	1st year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[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.

Continue to 物理工学総論Ａ（9・10・11・12組）(2)↓↓↓

未更新

Course number	U-ENG25 15111 LJ75　U-ENG25 15111 LJ28　U-ENG25 15111 LJ77		
Course title (and course title in English)	物理工学総論Ｂ（7・8・9組） Introduction to Engineering Science B	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUJI NOBUHIRO Graduate School of Engineering Professor,UDA TETSUYA Graduate School of Engineering Associate Professor,KUROKAWA SHIYUU Graduate School of Engineering Associate Professor,FUKAMI KAZUHIRO Graduate School of Engineering Associate Professor,SEKO ATSUTO Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Professor,KANNO IKUO Graduate School of Engineering Professor,MURAKAMI SADAYOSHI Graduate School of Engineering Professor,SAITOU MANABU Graduate School of Energy Science Professor,KAWANABE HIROSHI

Target year	1st year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,5times,
,4times,
,4times,
,1time,

[Course requirements]

None

Continue to 物理工学総論Ｂ（7・8・9組）(2)↓↓↓

物理工学総論Ｂ（7・8・9組）(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.

[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

物理工学総論Ｂ（9・10・11・12組）(2)

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 15111 LJ75　U-ENG25 15111 LJ28　U-ENG25 15111 LJ77		
Course title (and course title in English)	物理工学総論Ｂ（9・10・11・12組） Introduction to Engineering Science B	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,UDA TETSUYA Graduate School of Engineering Professor,TSUJI NOBUHIRO Graduate School of Engineering Associate Professor,KUROKAWA SHIYUU Graduate School of Engineering Associate Professor,FUKAMI KAZUHIRO Graduate School of Engineering Associate Professor,SEKO ATSUTO Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Professor,KANNO IKUO Graduate School of Engineering Professor,MURAKAMI SADAYOSHI Graduate School of Engineering Professor,SAITOU MANABU Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Energy Science Professor,KAWANABE HIROSHI
Target year	1st year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[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.

Continue to 物理工学総論Ｂ（9・10・11・12組）(2)↓↓↓

未更新

Course number	U-ENG25 45114 LJ57　U-ENG25 45114 LJ53		
Course title (and course title in English)	核物理基礎論（原） Fundamentals of Nuclear Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Assistant Professor,OGURE KENZOU Graduate School of Engineering Associate Professor,MIYADERA TAKAYUKI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Basics of nuclear structure will be explained.

[Course objectives]

To understand nuclear structure by using quantum theory.

[Course schedule and contents]

Properties of nuclei,1time,
Mass formula of nuclei,2times,
Structure of nuclei,2times,
Alpha decays and fission,2times,
Beta decays,1time,
Isospin, 2times
Relativistic particle, 1time
Relativistic field, 2times
Pion field, 1time
Confirmation of achievement in study,1time,

[Course requirements]

Quantum physics 1 and 2

[Evaluation methods and policy]

exam

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

solve problems presented in the lectures.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35115 LJ53　U-ENG25 35115 LJ72		
Course title (and course title in English)	加速器工学（原） Particle Accelerators	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TSUCHIDA HIDETSUGU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,2times,
,3times,
,2times,
,2times,
,3times,
,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.

放射化学（エネ原）**(2)**

[Evaluation methods and policy]

Grading is based on the score of the periodic evaluations. Students will be evaluated based on their demonstrated understanding of the physicochemical properties and reactivity of radioactive materials and the engineering processes involved.

[Textbooks]

Other materials are not specified. Handouts, etc. will be distributed during lectures.

[References, etc.]

（**Reference books**）

Other, Radiochemistry and Nuclear Chemistry, 4th ed., G. R. Choppin et al., Elsevier (2013) isbn{9780124058972};
Nuclear Chemical Engineering, 2nd Ed., M. Benedict et al., McGraw-Hill (1981) isbn{0070045313}, etc.

[Study outside of class (preparation and review)]

Focusing on reviewing lecture content and exercises is advisable.

（Other information (office hours, etc.)）

Attend as needed. Some materials may be omitted or added depending on the number of classes in the relevant year.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 35116 LJ77　U-ENG25 35116 LJ60		
Course title (and course title in English)	放射化学（エネ原） Radiochemistry	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SASAKI TAKAYUKI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Lectures on the use of radionuclides, recycling of spent fuel and disposal of radioactive waste, physicochemical fundamentals related to the reactivity of radioactive materials, and essential analytical methods for material state analysis.

[Course objectives]

The course objective is to develop an understanding of the physicochemical properties and reactivity of radioactive materials, and to learn the latest research and engineering applications based on these principles.

[Course schedule and contents]

The main contents of each class session are as follows:

1) Atoms, nuclei, and isotopes
2) Mass, decay and half-life, radiation equilibrium
3) Nuclides, dating, tracer chemistry
4) Dilution analysis, NAA
5) Cross-section, application (analysis, radiation source)
6) Nuclear fuel cycle
7) Cycle engineering: nuclear fuel, smelting, compounds
8) Overview of geological disposal (advance dispersion, chemical equilibrium)
9) Actinide chemistry
10) Chemical analysis and spectroscopy of actinide and fission products
11) Chemical thermodynamics (complexation, solubility)
12) Electrochemistry (redox, electric double layer)
13) Reprocessing (extraction equilibrium, extractant, countercurrent distribution)
14) Waste treatment (ion exchange reaction, membrane equilibrium)
15) Feedback; confirmation of learning achievement

[Course requirements]

N/A

Continue to 放射化学（エネ原）**(2)**↓↓↓

Course number	U-ENG25 35118 LJ75		
Course title (and course title in English)	エネルギー・材料熱化学 1 （材エネ） Thermochemistry for Energy and Materials Science 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,HIRATOU TETSUJI Graduate School of Energy Science Associate Professor,HASEGAWA MASAKATSU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Mon.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course will provide fundamentals of thermochemistry, which will be necessary to think about environmental-friendly materials production / recycling processes.

[Course objectives]

Students will be able to calculate thermochemical properties of pure substances, mixtures and solutions, and use phase diagrams.

[Course schedule and contents]

1st, 2nd and 3rd laws of thermodynamic(3 weeks)
Ellingham diagram and equilibrium in gas phase(3 weeks)
Activity in binary solution(2 weeks)
Phase diagram of binary system(3 weeks)
Standard state of activity(2 weeks)
Review(1 week)
Feedback(1 week)

[Course requirements]

None

[Evaluation methods and policy]

Results are evaluated by a term-end examination.
However, there are cases where the results of the quizzes in the lectures are considered.

[Textbooks]

Instructed during class

Continue to エネルギー・材料熱化学 1（材エネ）(2)↓↓↓

エネルギー・材料熱化学1（材エネ）(2)

[References, etc.]

（**Reference books**）
David R. Gaskell 『Introduction to metallurgical thermodynamics』（Scripta Pub. Co）ISBN:0070229457
Seshadri Seetharaman ed. 『Treatise on process metallurgy, vol.1 Process fundamentals』（Elsevier）ISBN: 9780080969862

（**Related URLs**）
http://www.lupin.mtl.kyoto-u.ac.jp/class.html

[Study outside of class (preparation and review)]
In order to be useful for review, quizzes submitted will be returned after checking.

（**Other information (office hours, etc.)**）
Please bring a scientific calculator and a ruler.

*Please visit KULASIS to find out about office hours.

エネルギー・材料熱化学2（材エネ）(2)

9780080969862

（**Related URLs**）
http://www.lupin.mtl.kyoto-u.ac.jp/class.html

[Study outside of class (preparation and review)]
In order to be useful for review, quizzes submitted will be returned after checking.

（**Other information (office hours, etc.)**）
Please bring a scientific calculator and a ruler.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35119 LJ75		
Course title (and course title in English)	エネルギー・材料熱化学２（材エネ） Thermochemistry for Energy and Materials Science 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,HIRATOU TETSUJI Graduate School of Energy Science Associate Professor,HASEGAWA MASAKATSU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]
This course will provide fundamentals of thermochemistry, which will be necessary to think about environmental-friendly materials production / recycling processes.

[Course objectives]
Students will be able to calculate thermochemical properties of pure substances, mixtures and solutions, and use phase diagrams.

[Course schedule and contents]
Regular solution model(3 weeks)
Gibbs-Duhem equation(1 week)
Henrian activity(1 week)
Gibbs phase rule(3 weeks)
Phase diagram of ternary system(4 weeks)
Nernst equation(1 week)
Review(1 week)
Feedback(1 week)

[Course requirements]
None

[Evaluation methods and policy]
Results are evaluated by a term-end examination.
However, there are cases where the results of the quizzes in the lectures are considered.

[Textbooks]
Instructed during class

[References, etc.]

（**Reference books**）
David R. Gaskell 『Introduction to metallurgical thermodynamics』（Scripta Pub. Co）ISBN:0070229457
Seshadri Seetharaman ed. 『Treatise on process metallurgy, vol.1 Process fundamentals』（Elsevier）ISBN:

Continue to エネルギー・材料熱化学2（材エネ）(2)↓↓↓

Course number	U-ENG25 35120 LJ75		
Course title (and course title in English)	材料分析化学（材） Analytical Sciences	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KAWAI JIYUN
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]
Quantum spectrochemistry, which is a basis of spectrochemical analysis, will be lectured. Various kinds of spectrometries which are used in materials analysis will also be explained.

[Course objectives]
The goal of the course is to obtain knowledges about quantum chemistry, interaction between photons and electrons, spin, principles of spectrometers, quantum mechanical calculations related to spectroscopy, and so forth, which are necessary for spectrochemical analysis.

[Course schedule and contents]
1. Quantization,1time,Bragg diffraction equation deduced from Bohr-Sommerferd quantization. Compton scattering equation explained from both wave and particle views.
2. Principle of least action,2times,Refraction of electron beam. Phase velocity and group velocity. Spin and helicity of photon. Polarization of light. Inertial mass and gravitational mass of photon and its relation to Maessbauer spectroscopy. Zeeman effect.
3. Matrix mechanics,1time,Scheroedinger equation. Matrix mechanics. Role of harmonic oscillator in atomic spectra.
4. Perturbation theory,2times,Time independent perturbation theory applied to ionic crystal.
5. Optical transition,2times,Blackbody radiation. Time dependent perturbation. Tsallis entropy. Electric dipole transition.
6. Harmonic oscillator,1time,Harmonic oscillator. WKB approximation. Field quantization.
7. Electron spectroscopy,1time,Photoelectron spectroscopy of transition metal compounds. Configuration interaction.
8. Symmetry,1time,Symmetry of molecules. Group theory. Projection operator.
9. Interaction between electrons and photons,2times,IR and Smekal-Raman spectroscopy.
10. Angular momentum and spin,1time,Angular momentum and spin. Spin-orbital interaction.
11. Check of achievement,1time,

[Course requirements]
None

[Evaluation methods and policy]
Checked only by exam.

Continue to 材料分析化学（材）(2)↓↓↓

材料分析化学（材）(2)

[Textbooks]

J. Kawai, quotQuantum Spectrochemistryquot, 2nd Edition, AGNE Gijutsu Center, Tokyo (2015).(ISBN: 9784901496759) isbn{}{9784901496759}

[References, etc.]

（**Reference books**）

（**Related URLs**）

(http://www.process.mtl.kyoto-u.ac.jp/)

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

固体電子論（材）(2)

[Evaluation methods and policy]

Final test, quizzes

[Textbooks]

Printouts will be provided

[References, etc.]

（**Reference books**）
『固体物理学入門（上）（下）』（丸善）ISBN:9784621076538
志賀正幸『材料科学者のための固体電子論入門』ISBN:9784753655533

[Study outside of class (preparation and review)]

do exercises at course printouts

（**Other information (office hours, etc.)**）

In addition, course printouts will be distributed

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35121 LJ75		
Course title (and course title in English)	固体電子論（材） Electon Theory of Solids	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,KUROKAWA SHIYUU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course focuses on the electron theory of solids and its applications. First, we review the concept of energy bands and the basics of band theory. Next, we discuss the fact that the electronic properties of solids such as metals and semiconductors can be explained by thinking in terms of band structure. Next, we gain an understanding of semiconductor properties based on information about bands. We also discuss the main structural characteristics of actual electronic devices such as p-n junctions. Finally, we explain the electronic states and electronic defect states of surfaces/interfaces with interrupted solid periodic potential.

[Course objectives]

Understand concepts that are important in discussing electrons in solids (refer to syllabus). Understand general information concerning the electronic properties of metal and semiconductors.

[Course schedule and contents]

Energy bands, 4 classes: Review free electron theory, the influence of periodic potential, the occurrence of energy gaps, Bloch’s theorem, one-dimensional energy bands, reduced zones, expanded zones, periodic zone schemes, reciprocal lattices and Brillouin zones.
Fermi surfaces and band structure of metal, 3 classes: Three-dimensional lattice Fermi surfaces and energy band diagrams, differences between metal and insulators, band structure of metal, rigid band model, Hume-Rothery rules.
Semiconductors, 4 classes: Movement of Bloch electrons in electric fields, concept of effective mass, movement of electron holes, Fermi level and carrier density, intrinsic semiconductors, extrinsic semiconductors, p-n junctions, carrier diffusion, operating principles of transistors.
Surface/interface/defect electronic states, 2 classes: Notation of electron arrangement in crystal surfaces, band structure of surfaces, work functions, surface electronic states.
Latest topics, 1 class: Discuss the latest research and technologies related to the content of the course. Review the course overall and confirm the degree of learning attainment.

[Course requirements]

Students should have completed the solid state physics course offered by the Department of Physical Scienceand Engineering.

Continue to 固体電子論（材）(2)↓↓↓

未更新

Course number	U-ENG25 35124 SJ71　U-ENG25 35124 SJ77		
Course title (and course title in English)	インターンシップ（機） Internship	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HASUO MASAHIRO Graduate School of Engineering Professor,KUROSE RYOUICHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

The aim of the internship is experiencing on-site activities involved production, manufacturing, development, designing and research of industrial goods at a factory or a research laboratory of Japanese leading companies. On-site learning of the importance of teamwork and production processes in manufacturing is also the aim.

[Course objectives]

The goal of the internship is to master a general method of thinking and methodology at Mechanical Engineering. Furthermore, by learning the relationship between a human and machines at an industry, motivate oneself to study and think about one's career development.

[Course schedule and contents]

As a general rule, the internship should meet the above purpose. The duration should be not less than two weeks. Thus, the following cases are not approved as an internship; a short internship such as a week, a company tour, a company explanation meeting and so on. Longer term more than two weeks and an overseas internship such as IAESTE can be acceptable.
Internship location: Based on recruitment from companies. You can find them at company's web sites and/or the educational affairs office of the Engineering Science office (Butsuri Kyoumu).

[Course requirements]

None

[Evaluation methods and policy]

Credits (2) are approved based on the summary report (50%) and presentation (50%) about the internship activities.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Consult with the internship host location.

（**Other information (office hours, etc.)**）

Pre-registration at the educational affairs office of the Engineering Science (Butsuri Kyoumu) is required.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35124 SJ71　U-ENG25 35124 SJ77		
Course title (and course title in English)	インターンシップ（原） Internship	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to インターンシップ（原）(2)↓↓↓

未更新

Course number	U-ENG25 35125 LE77　U-ENG25 35125 LE48		
Course title (and course title in English)	物理工学英語（原） English for Engineering Science	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/Intensive, First semester		
Days and periods	Intensive	Class style	Lecture
Language of instruction	Japanese and English		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,14times,
,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.

[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 that includes off-campus training classes.

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

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

未更新

Course number	U-ENG25 25127 LJ71		
Course title (and course title in English)	機械設計製作（機エネ宇） Design and Manufacturing Processes	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Professor,NISHIWAKI SHINJI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,3times,
,4times,
,7times,
,4times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 機械設計製作（機エネ宇）(2)↓↓↓

機械設計製作（機エネ宇）**(2)**

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

システム工学（エネ原）**(2)**

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

Instruct in class.

（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

未更新

Course number	U-ENG25 35128 LJ77		
Course title (and course title in English)	システム工学（エネ原） Systems Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,KAWANABE HIROSHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Systems engineering is basic idea about a system assembled with some elements. In the course, modeling method of a system, function analysis, economical evaluation, optimization method and reliability analysis are offered. Also, energy system as one of application cases; a thermal and power plant is lectured.

[Course objectives]

- To understand a variety of method and characteristics of system analysis.

- To acquire the basic knowledge to optimize the energy systems.

[Course schedule and contents]

1. Introduction of systems engineering(2): Lectures on definition and structure of a system and basic performance of a system. Also, lecture the basics of systems engineerings.

2. Schedule planning method(2): Lectures on the method of a program for work processes. "Program Evaluation and Review Technique" and "Critical Path Method" are lectured.

3. Linear programming(5): Lectures on LP method for the optimization of a system. For the application example, analysis of energy system is also offered.

4. Decision-making problem(2): Lectures on a modeling of decision-making process and method for optimization.

5. System reliability analysis(2): Lectures on a system design and reliability analysis method.

6. Application for a energy system(2): Systems engineering method is applied to thermal and power plants.

[Course requirements]

None

[Evaluation methods and policy]

Evaluate by report(s) and examination.

[Textbooks]

Instructed during class

Continue to システム工学（エネ原）**(2)**↓↓↓

未更新

Course number	U-ENG25 35129 LJ75		
Course title (and course title in English)	構造物性学（材） Structural Properties of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,NOSE YOSHITAROU Graduate School of Engineering Associate Professor,SHIBATA AKINOBU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

The properties of metals and alloys strongly depend on thier microstructures, which are controlled by processing. In this lecture, we talk on formation mechanism on micro- and nano-structures in metals and alloys from the atomistic viewpoints, and on their properties. Through the lecture, how to control or utilize practical materials are studied.

[Course objectives]

To study relationship between microstructures and properties in metals and alloys. To understand formation mechanism of microstructures through each phase transformation and its control.

[Course schedule and contents]

(1) Thermodynamics, phase diagram and atomic diffusion [2-3 weeks]
(2) Phase transformation through diffusion [4-5 weeks]
(3) Diffusionless phase transformation [3-4 weeks]
(4) Recrystallization and recovery [3-4 weeks]
(5) Feedback [1 week]

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on a written examination.
In some cases, reports and attend are considered.

[Textbooks]

Utilizing resumes provided in the lecture.

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

To review contents in the last time before the lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35130 LJ57		
Course title (and course title in English)	統計力学（原） Statistical Mechanics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TASAKI SEIJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

機械システム学演習（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG25 35131 SJ71		
Course title (and course title in English)	機械システム学演習（機） Exercise on Mechanical and System Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Graduate School of Engineering Associate Professor,IZUI KAZUHIRO Graduate School of Engineering Professor,YOKOKAWA RYUUJI

Target year	3rd year students or above	Number of credits	1	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

This seminar provides exercise on various topics in mechanical engineering. Students should register in advance (in July).

[Course objectives]

[Course schedule and contents]

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[Course requirements]

None

[Evaluation methods and policy]

Depends on topics.

Continue to 機械システム学演習（機）**(2)**↓↓↓

Course number	U-ENG25 25133 LJ75		
Course title (and course title in English)	物質科学基礎（材） Fundamentals of Materials Science	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,MURASE KUNIAKI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Fri.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Based primarily on the solid-state chemistry, this course serves the outline of notation (descriptive method) and analytical techniques for solid substances, which become the basis of materials science and materials engineering.

[Course objectives]

Basic knowledges of physics, chemistry, mathematics, etc. are requires to learn materials science and materials engineering. In this course students learn basic technical terms and develop fundamental concepts of solid-state materials chemistry, to take subsequent advanced courses on materials science and materials engineering.

[Course schedule and contents]

Substances and materials, 1 time, Three states of matter; Amorphous and glasses; Liquid crystal; Materials structures and properties in our surrounding living environment.
Fundamentals of crystal structures, 3 times, Close packing and holes; Crystal structure of metals; Point symmetry and space symmetry; Lattice and unit structure; Crystal system and Bravais lattice; Depiction of lattice plane and lattice direction; Fractional coordinates.
Fundamentals of chemical bond theory, 2 times, Electronic configuration and shielding; Size of atoms and ions; Covalency and ionicity; Definition of electronegativity.
Inorganic solid-state materials, 3 times, Structure of important ionic crystals; Stoichiometry and lattice defects; Ionic conduction and solid electrolytes; Crystal field and optical properties of d-block elements.
Fundamentals of diffraction crystallography, 5 times, Generation and properties of X-ray; Fundamentals of X-ray scattering and diffraction (Bragg condition, structure factor, extinction rule); Powder X-ray diffractometry; Laue method
Self-assessment of achievement, 1 time, Review of the course contents

[Course requirements]

Knowledge of physics and chemistry for the entrance examination of Kyoto University.

[Evaluation methods and policy]

(1) Class participation, (2) take-home assignments (approx. 50% in total), and (3) exams (approx. 50%). Students will sign a roll sheet every class. Ten written take-home assignments are due throughout the semester. Supplementary examination to bail out low-performing students will not be given for any reason.

Continue to 物質科学基礎（材）**(2)**↓↓↓

物質科学基礎（材）(2)

[Textbooks]

No textbook is required for this course. A course booklet will be given out at the first lecture.

[References, etc.]

（**Reference books**）

B. D. Cullity, S.R. Stock 『Elements of X-Ray Diffraction (3rd ed.)』 （Prentice Hall）ISBN: 9780201610918

L. Smart, E. Moore 『Solid State Chemistry: An Introduction (4th ed.)』 （CRC Press）ISBN: 9781439847909

A. R. West 『Solid State Chemistry and Its Applications (2nd ed.)』 （Wiley）ISBN:9781119942948

（**Related URLs**）

(Not available)

[Study outside of class (preparation and review)]

The take-home assignments and their suggested answers should effectively be used for preparation and review.

（**Other information (office hours, etc.)**）

Not available

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25135 LJ75		
Course title (and course title in English)	材料科学基礎１（材） Fundamentals of Materials Science I	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,KISHIDA KIYOUSUKE Graduate School of Engineering Associate Professor,NOSE YOSHITAROU
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Wed.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

To understand structures in solids, mainly metal crystals, from the viewpoint of atomic interaction. Based on the knowledge, to study fundamental characteristics of lattice defects and properties in crystalline solid materials controlled by it, in particular diffusion and mechanical strength.

[Course objectives]

The aim of this lecture is to learn a way of considering to understand diffusion and mechanical properties in addition to fundamental studies on crystals and lattice defects.

[Course schedule and contents]

(1) Structure of solids【1 week】
(2) Lattice defects【1 week】
(3) Diffusion in solids【5 weeks】
(4) Deformation of crystalline materials【2 weeks】
(5) Plastic deformation of single crystals of metallic materials【2 weeks】
(6) Plastic deformation of polycrystalline metals【2 weeks】
(7) Deformation twinning and creep deformation【1 week】
(8) Feedback【1 week】

[Course requirements]

None

[Evaluation methods and policy]

A end-term examination will be a main part of grading determination. Attendance and daily reports may be considered in grading determination.

[Textbooks]

Utilizing resumes provided in the lecture.

[References, etc.]

（**Reference books**）

Introduced during class

[Study outside of class (preparation and review)]

To review contents in the last time before the lecture.

（**Other information (office hours, etc.)**）

A part of themes will be added or omitted depending on a number of classes in the term.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25134 LJ75		
Course title (and course title in English)	材料統計物理学（材） Statistical Physics of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TABATA YOSHIKAZU Graduate School of Engineering Associate Professor,YUGE KORETAKA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

First and second law of thermodynamics, Irreversible process,2times,
Thermodynamic functions, Phase Equilibrium and Phase Transition,2times,
Analytical mechanics and concept of statistical mechanics,3times,
Basic of classical statistical thermodynamics,2times,
,3times,
Quantum statistical thermodynamics,3times,
Check of acquisition,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25136 LJ75		
Course title (and course title in English)	材料科学基礎２（材エネ） Fundamentals of Materials Science II	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,ICHII TAKASHI Graduate School of Engineering Associate Professor,SHIBATA AKINOBU Graduate School of Engineering Associate Professor,FUKAMI KAZUHIRO
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This lecture focuses on symmetry, tensor and elastodynamics that are of importance for materials science.

[Course objectives]

To understand the role of symmetry, tensor and elastodynamics on materials science.

[Course schedule and contents]

Vector and tensor,4-5times,Fundamentals of vector and tensor
Symmetry in molecules and crystals,4-5times,Fundamentals of symmetry in molecules and crystals
Elastodynamics,4-5times,Fundamentals of elastodynamics

[Course requirements]

Fundamentals of thermodynamics

[Evaluation methods and policy]

Grading is due to the term-end examination. The record of attendance may be taken into account.

[Textbooks]

Handouts will be given in lectures.

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35139 LJ76		
Course title (and course title in English)	エネルギー化学１（エネ原） Energy chemistry 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,HAGIWARA RIKA

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Fundamental chemistry such as quantum chemistry, solid state chemistry, physical chemistry will be described in this course for deeper understanding of energy conversion and applications. Especially chemical bonding and structures and their energetics will be discussed in this course.

[Course objectives]

Deeper understanding of energy conversion and applications from the viewpoint of chemistry

[Course schedule and contents]

Atomic structure,2times,Understanding of fundamentals of inorganic chemistry such as atomic orbital, electronic structure of many-electron atoms, atomic radii, ionic radii, lanthanide contraction, ionization potential, electron affinity and electronegativ.
,3times,Understanding of fundamentals of inorganic solid state chemistry such as crystal lattice, symmetry of crystal, close packing structure, metals, alloys, intermetallic compounds, ionic crystals and covalent crystals
,2times,The factors such as ionic radii, coordination number, lattice energy affecting the crystal structure will be described. Thermochemistry of solid compounds will be discussed.
,3times,Chemical bonding theory and energetics such as Lewis structure, resonance structure, valence bond theory, molecular geometry and VSEPR theory, hybridization orbital, molecular orbital, bond length, bonding radii, bond energy will be described.
,2times,Symmetry operation and symmetry elements, molecular point groups will be described. Applications to molecular orbitals, molecular vibration, vibrational spectroscopies will be discussed.
,3times,Concepts and theory of Bronsted acids and bases, Lewis acids and bases, their reactions, solvent effects will be described. Learning achievement evaluation will be made in the last class.

[Course requirements]

None

[Evaluation methods and policy]

Overall evaluation of the activity in the class, homework, and term-end exam

Continue to エネルギー化学１（エネ原）(2)↓↓↓

Course number	U-ENG25 35140 LJ76		
Course title (and course title in English)	エネルギー化学２（エネ原） Energy chemistry 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,MATSUMOTO KAZUHIKO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.4	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

The lecturer teaches fundamental matters in inorganic chemistry related to energy conversion and storage. In particular, Redox reactions, analytical methods, molecular geometries, and coordination chemistry as well as electrochemical energy conversion devices will be lectured.

[Course objectives]

Understanding fundamental matters on energy conversion and utilization related inorganic chemistry as well as their relations to daily life and state-of-the-art researches

[Course schedule and contents]

1. Oxidation and Reduction, 3times,
reduction potentials, redox stability, diagrammatic presentation of potential data, chemical extraction of the elements
2. Molecular symmetry, 2times,
an introduction to symmetry analysis, applications of symmetry, symmetries of molecular orbitals, representations
3. An introduction to coordination chemistry, 2times
language of coordination chemistry, constitution and geometry, isomerism and chirality, thermodynamics of complex formation
4. Physical techniques in inorganic chemistry, 2 times
diffraction methods, absorption spectroscopy, resonance techniques, ionization-based techniques, chemical analysis, magnetometry, electrochemical techniques, microsope techniques
5. Periodic trends, Hydrogen, Group 1 and 2 elements, 1 time
periodic properties, periodic characteristics of compounds, hydrogen, alkali metal, and alkali earth metal compounds, topics related to energy chemistry (hydrogen energy system, secondary batteries)
6. Group 13, 14, 15, and 16 elements, 1 time
boron, aluminium, carbon, silicon, nitrogen, and chalcogen compounds, topics related to energy chemistry (carbonaceous materials, solar cells, energy resources)
7. Exercises and comments, 3 times
Exercises and comments on the topics in this lecture
8. Summary, once

Continue to エネルギー化学２（エネ原）(2)↓↓↓

[Textbooks]

Shriver amp Atkins#039 Inorganic Chemistry, the 6th ed., Oxford University Press.

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

Homeworks will be occasionally assigned as supplementary exercises. Depending on the progress in the class, schedule may be partially changed. Homeworks and supplementary materials are provided at URL:http://www.echem.energy.kyoto-u.ac.jp The text book will be used in Energy chemistry II held in fall semester.

*Please visit KULASIS to find out about office hours.

[Course requirements]

Students are supposed to understand the lecture "Energy Chemistry 1".

[Evaluation methods and policy]

Evaluation will be based on assignments and exercises (40 %) and final examination (60%).

[Textbooks]

Shriver & Atkins; Inorganic Chemistry (6th Ed.) ISBN 9784807908981 which is used in Energy Chemistry 1. isbn{}{9784807908981}

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Reading the textbook and reviewing the assignments are recommended.

（Other information (office hours, etc.)）

Assignments are given every week to support understanding of the lecture.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35141 LJ53　U-ENG25 35141 LJ77　U-ENG25 35141 LJ57		
Course title (and course title in English)	中性子理工学（原） Neutron Physics and Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TASAKI SEIJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

流体力学１（機）**(2)**

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 25142 LJ77　U-ENG25 25142 LJ71		
Course title (and course title in English)	流体力学１（機） Fluid Dynamics1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KUROSE RYOUICHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Fundamental of fluid dynamics: introduction, fluid properties, governing equations (Navier-Stokes equations, N-S equations), solution methods of N-S equations, laminer/turbulent flows, boundary layer flow.

[Course objectives]

Understanding of the principle of fluid flow.

[Course schedule and contents]

1 time : Introduction
2 time : Stationary fluid
4 times: Viscous fluid (Laminar flow /Turbulent flow)
5 times: Macroscopic expression of fluid motion
2 times: Exercise
1 times: Summary

[Course requirements]

N/A

[Evaluation methods and policy]

Term-end exam

[Textbooks]

Instructed during class

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Instructed during class.

Continue to 流体力学１（機）(2)↓↓↓

未更新

Course number	U-ENG25 25142 LJ77　U-ENG25 25142 LJ71		
Course title (and course title in English)	流体力学１（エネ原宇） Fluid Dynamics1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,OOWADA TAKU Graduate School of Engineering Senior Lecturer,SUGIMOTO HIROSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 流体力学１（エネ原宇）(2)↓↓↓

流体力学１（エネ原宇）**(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.

未更新

Course number	U-ENG25 35143 LJ71　U-ENG25 35143 LJ77		
Course title (and course title in English)	流体力学２（エネ宇） Fluid Dynamics2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,OOWADA TAKU Graduate School of Engineering Senior Lecturer,SUGIMOTO HIROSHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,3times,
,3times,
,6times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35143 LJ71　U-ENG25 35143 LJ77		
Course title (and course title in English)	流体力学２（機） Fluid Dynamics2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HANAZAKI HIDESHI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

Fluid Dynamics 1

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

G. K. Batchelor, An Introduction to Fluid Dynamics (Cambridge University Press, 1967). isbn{}{052104118X}, (同, 2000) isbn{}{9780521663960}

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45144 LJ71		
Course title (and course title in English)	マイクロ加工学（機エネ） Microfabrication	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Professor,YOKOKAWA RYUUJI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

This course covers microfabrication technology for MEMS as well as semiconducors.

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to マイクロ加工学（機エネ）(2)↓↓↓

マイクロ加工学（機エネ）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

航空宇宙工学演義（宇）(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 45145 LJ77		
Course title (and course title in English)	航空宇宙工学演義（宇） Engineering Exercise in Aeronautics and Astronautics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Professor,TAKATA SHIGERU
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.3,4	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（Reference books）

Continue to 航空宇宙工学演義（宇）(2)↓↓↓

未更新

Course number	U-ENG25 25150 LJ57　U-ENG25 25150 LJ28　U-ENG25 25150 LJ77		
Course title (and course title in English)	固体物性論（材エネ） Condensed Matter Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI Graduate School of Engineering Associate Professor,TABATA YOSHIKAZU
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Basic concept of optical, magnetic and superconducting properties of matters.

[Course objectives]

Understanding of basic concept of optical, magnetic and superconducting properties of matters.

[Course schedule and contents]

Review of electromagnetism, 2times, Maxwell's equations and electromagnetic wave, vector potential, Hamiltonian for charged particle in electromagnetic field, etc.
Optical properties of matter, 3times, optical constants, electromagnetic wave in solid, Lorentz model, Drude model, band structure and optical response, Kramers-Kronig relation, etc.
Magnetism, 6times, magnetic moment, atomic magnetism, single-ion magnetism, paramagnetism, ferromagnetism, antiferromagnetism, molecular field, metallic magnetism, magnetic anisotropy, magnetization process, etc.
Superconductivity, 3times, Meisner effect, type-1 and type-2 superconductivity, London equation, flux quantization, origin of superconductivity, Josephson effect, SQUID, etc.
Assessment, 1time, Assessment

[Course requirements]

None

[Evaluation methods and policy]

Evaluation will be based on a final examination.

[Textbooks]

Not used

[References, etc.]

（Reference books）
S. Blundel 『Magnetism in Condensed Matter (Oxford Master Series in Physics)』（Oxford University Press）ISBN:0198505914
C. Kittel 『Introduction to Solid State Physics』（Wiley）ISBN:9780471415268

[Study outside of class (preparation and review)]

Basics of quantum mechanics and statistical mechanics is necessary.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25151 LJ77　U-ENG25 25151 LJ57　U-ENG25 25151 LJ28		
Course title (and course title in English)	量子物性基礎論（原） Introduction to Solid State Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,MATSUO JIROU Graduate School of Engineering Senior Lecturer,SEKI TOSHIO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Gain working understanding of periodicity in solids and how this periodicity and bonding governs solid properties, such as electrically magnetically and mechanically. To describe how quantum mechanics defines solid state properties on a microscopic and macroscopic scale.

[Course objectives]

To further develop the understanding of interactions between solid state and phonons, electrons and particles on a microscopic scale.

[Course schedule and contents]

Introduction, 1 times,Revision of ccrystal type and structure
Free electron model,3times,Wave function theory of one dimensional lattice, energy state and Fermi surface
Band structure,3times,Blochrsquos theory, Brillouin zone, Laue law, diffraction and structural factor
Defects and dislocations,2times,Vacancy, diffusion, color center
Optical property,2times,Kramers-Kronig relation, Drude theory, electron gas, Plasmon
Semiconductor,1time,Band gap, electrons and holes, Homogeneous semiconductor, doping
Junction theory,1time,p-n junctions, metal-semiconductor junction, hetero-junction
Final examination and report,2times,Evaluation will be given by the contents of the reports and quizzes of the subjects leaned in this course.

[Course requirements]

None

[Evaluation methods and policy]

Coursework will be evaluated with attendance and report on subjects.

[Textbooks]

[References, etc.]

（**Reference books**）
C. Kittel, Introduction to Solid State Physics 8th edition (Wiley) isbn{}{9780471415268}

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

原子核工学序論１（原）**(2)**

[Course requirements]

N/A

[Evaluation methods and policy]

Grading is based on the score of the periodic evaluations. Students will be tested on basic knowledge and understanding of atoms, nuclei, radiation, quantum computation, etc. discussed in each lecture.

[Textbooks]

Other materials are not specified. Handouts, etc. will be distributed during lectures.

[References, etc.]

（**Reference books**）
N/A

[Study outside of class (preparation and review)]

Review mainly the contents of each lecture and the exercises during the lecture is advisable.

（**Other information (office hours, etc.)**）

Attend as needed. Some materials may be omitted or added depending on the number of classes in the relevant year. Attending Introduction to Nuclear Engineering 2 at the same time as this course is desirable.

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 35200 LJ75		
Course title (and course title in English)	原子核工学序論１（原） Introduction to Nuclear Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Professor,SASAKI TAKAYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Study of basic concepts necessary for understanding the principles of various nuclear engineering studies from the physicochemical properties of atoms, nuclei, and radiation to the generation and use of energy by fission reactions.

[Course objectives]

The course objective is to understand the link between basic science and the latest research in the field of nuclear engineering, and to understand the latest advancements made in basic and applied research and future issues.

[Course schedule and contents]

Introduction to Radiation 1

1) Discovery of radiation
2) History of radiation
3) Basics of radiation
4) Interaction with substances
5) Detection of radiation
6) Generation of radiation
7) Industrial uses of radiation

Energy generation and utilization 1

8) Energy situation and nuclear power
9) Basics of reactor physics
10) Reactor control
11) Reactor selection-present
12) Reactor selection-past
13) Reactor selection-next generation reactor
14) Viewpoints on nuclear energy utilization and development
15) Feedback; confirmation of learning achievement

Continue to 原子核工学序論１（原）**(2)**↓↓↓

Course number	U-ENG27 27132 LJ55　U-ENG27 27132 LJ61		
Course title (and course title in English)	原子核工学序論２（原） Introduction to Nuclear Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Professor,SASAKI TAKAYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Study of the fundamentals of radiation properties and their control, and energy utilization and management, necessary for understanding the principles of various nuclear engineering studies.

[Course objectives]

The course objective is to understand the association between basic science and the latest research in the field of nuclear engineering, and to understand the latest advancements made to basic and applied research and future issues.

[Course schedule and contents]

Introduction to Radiation 2

1) Radiation biology
2) Medical application of radiation
3) Effects of radiation on the human body
4) Safe use of radiation
5) Radiation-related laws and regulations

New developments in quantum theory
6) Cutting-edge information technology

Energy generation and utilization 2
7) History and fundamentals of nuclear fusion
8) Fusion reactor development
9) Power reactor systems
10) Ensuring safety
11) Technical ethics
12) Radiation in the environment
13) Nuclear fuel cycle
14) Reprocessing and geological disposal
15) Feedback; confirmation of learning achievement

Continue to 原子核工学序論２（原）**(2)**↓↓↓

未更新

原子核工学序論 2（原）**(2)**

[Course requirements]

N/A

[Evaluation methods and policy]

Grading is based on the score of the periodic evaluations. Students will be tested on basic knowledge and understanding of atoms, nuclei, radiation, quantum computation, etc. discussed in each lecture.

[Textbooks]

Other materials are not specified. Handouts, etc. will be distributed during lectures.

[References, etc.]

（**Reference books**）
N/A

[Study outside of class (preparation and review)]

Review mainly the contents of each lecture and the exercises during the lecture is advisable.

（Other information (office hours, etc.)）

Attending Introduction to Nuclear Engineering 1 is desirable. Exercises and report tasks will be assigned as necessary. Some materials may be omitted or added depending on the number of classes in the relevant year.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35155 LJ71		
Course title (and course title in English)	伝熱工学（機） Heat Transfer	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,IWAI HIROSHI Graduate School of Engineering Associate Professor,TATSUMI KAZUYA

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This course focuses on the heat transfer phenomena at the foundation of heating, cooling, and insulation techniques, that is heat conduction, convection heat transfer, and thermal radiation. With respect to heat conduction, we will discuss the steady-unsteady phenomenon and the theory of extended surface heat transfer. With respect to convective heat transfer, we will discuss single-phase forced convection/natural convection and the boiling and condensation transfer accompanying phase transitions. With respect to thermal radiation, we will discuss the basic theory.

[Course objectives]

Provide basic knowledge and deepen understanding of heat transfer phenomena (heat conduction, convective heat transfer, thermal radiation).

[Course schedule and contents]

(1)
General information: Based on multiple examples of energy conversion requiring heating, cooling, and insulation techniques, and temperature control of equipment, explain the importance of heat transfer engineering and the basic mechanisms of heat transfer phenomena.
(2-4)
Heat conduction: Explain the basics of heat conduction phenomena, specifically heat flux, thermal conductivity and Fourier’s law, and the derivation of the equation of heat conduction, with reference to basic case examples. Explain thermal contact resistance, steady heat conduction, and heat conduction resistance in flat plates, pipes, etc., the theory of extended surfaces (fins), and so on.
(5)
Basic information on convective heat transfer: Formularize the governing equations of flow in heat transfer. Explain dimensionless numbers such as Prandtl number, Nusselt number, Stanton number, Grashof number, and Rayleigh number. Derive the momentum and energy equations for the boundary layer flow and heat transfer.
(6-9)
Convective heat transfer without phase change: Explain specific examples of forced convective heat transfer, as well as general information. As examples of external flow heat transfer, explain laminar and turbulent boundary layer flow over a flat plate accompanying heat transfer. Also, as an example of internal flow heat transfer, explain heat transfer of flows within tubes. Also, explain natural convection along a vertical heated plate.
(10, 11)
Convective heat transfer accompanying phase changes: With respect to boiling heat transfer, explain the boiling curve in pool boiling and nucleate boiling, transition boiling, film boiling heat transfer mechanisms, and the effects of various factors that affect nucleate boiling heat transfer and methods to enhance heat

Continue to 伝熱工学（機）(2)↓↓↓

未更新

Course number	U-ENG25 35154 LJ75		
Course title (and course title in English)	流体熱工学（原） Fluid Flow and Heat Transfer	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,YOKOMINE TAKEHIKO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

This lecture provides the following subjects: thermal radiation, steady and unsteady heat conduction, laminar and turbulent convective heat transfer, phase change phenomena (boiling and condensation). The main goals are to understand the basic theory of fluid dynamics, thermodynamics, heat transfer and their allocation through the understandings of the mechanisms of heat transfer; especially thermal hydraulics in a nuclear reactor as a typical energy conversion system will be discussed including a safety engineering point of view.

[Course objectives]

In order to understand the relation between heat and fluid based on the basic theory of fluid dynamics, thermodynamics, heat transfer and their allocation. It is very important to

[Course schedule and contents]

,1.0times,
,1.0times,
,2.0times,
,4.0times,
,1.0times,
,5.0times,
, 1 .0times,

[Course requirements]

None

[Evaluation methods and policy]

Evaluation based on the written examination, but it is also rating a student#039s class performance.

[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.

伝熱工学（機）(2)

transfer. With respect to condensation heat transfer, explain the difference between dropwise condensation and film condensation, phenomena in condensation interfaces, and the Nusselt solution in vertical plate film condensation.
(12-14)
Radiation heat transfer: Discuss black bodies and gray bodies, Kirchhoff’s law, Planck’s law, and Wien’s displacement law, Stefan-Boltzmann’s law, radiation transfer between black body surfaces and radiation in actual surfaces, and the properties of radiation in gases.
(15)
Confirmation of learning attainment.

[Course requirements]

Students are required to have completed Thermodynamics 1, Thermodynamics 2, Fluid Dynamics 1, and Fluid Dynamics 2.

[Evaluation methods and policy]

A final examination will be held. In-class quizzes and reports, when carried out, will be factored in.

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Students are required to have completed Thermodynamics 1, Thermodynamics 2, Fluid Dynamics 1, and Fluid Dynamics 2.

（Other information (office hours, etc.)）

The order of classes listed above and their timing may differ depending on the year.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35156 LJ71		
Course title (and course title in English)	材料基礎学２（エネ） Fundamentals of Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,OKUMURA HIDEYUKI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Text book can be bought at the society of material science, Japan at Hyakumanben near Kyoto university.
http://www.jsms.jp/

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35158 EJ57　U-ENG25 35158 EJ53　U-ENG25 35158 EJ77		
Course title (and course title in English)	設計工学２ Design Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KOMORI MASAHARU Graduate School of Engineering Professor,MATSUBARA ATSUSHI Graduate School of Engineering Professor,NISHIWAKI SHINJI
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Tue.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,5times,
,3times,
,2times,
,4times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 設計工学２(2)↓↓↓

未更新

Course number	U-ENG25 35157 EJ28		
Course title (and course title in English)	設計工学１ Design Engineering 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KOMORI MASAHARU Graduate School of Engineering Professor,HIRAYAMA TOMOKO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Mon.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

設計工学２(2)

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

[Courses delivered by instructors with practical work experience]

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

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

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

未更新

Course number	U-ENG25 35159 SJ28		
Course title (and course title in English)	エネルギー応用工学設計演習・実験 1 Design Practice and Experiments for Applied Energy Science and Engineering 2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Associate Professor,OKUMURA HIDEYUKI Graduate School of Energy Science Associate Professor,ABE MASATAKA Graduate School of Energy Science Assistant Professor,IKENOUE TAKUMI Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Energy Science Assistant Professor,OGAWA TAKAYA Graduate School of Energy Science Professor,KASHIWAYA YOSHIAKI Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI Graduate School of Energy Science Associate Professor,HASEGAWA MASAKATSU Graduate School of Energy Science Associate Professor,HACHIYA KAN Graduate School of Energy Science Associate Professor,Jun HAYASHI Graduate School of Energy Science Assistant Professor,HORIBE NAOTO Graduate School of Energy Science Associate Professor,MATSUMOTO KAZUHIKO Graduate School of Energy Science Associate Professor,MIYAKE MASAO
Target year	3rd year students or above	Number of credits	3
Year/semesters	2020/First semester		
Days and periods	Wed.3,4,Thu.3,4	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,6times,
,6times,
,6times,
,6times,

Continue to エネルギー応用工学設計演習・実験 1 (2)↓↓↓

未更新

Course number	U-ENG25 35160 SJ57 U-ENG25 35160 SJ53 U-ENG25 35160 SJ77		
Course title (and course title in English)	原子核工学実験 1 Nuclear Engineering Laboratory 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering ALL STAFF Graduate School of Engineering Associate Professor,TASAKI SEIJI
Target year	3rd year students or above	Number of credits	3
Year/semesters	2020/First semester		
Days and periods	Thu.1,2,3,4	Class style	Experiment
Language of instruction	Japanese		

[Overview and purpose of the course]

Basic knowledge of a wide range of scientific and engineering fields (e.g. physics, chemistry, biology, electrical engineering, mechanical engineering, and materials engineering) that form the basis of nuclear engineering, as well as basic proficiency with standards related to radiation and quantum beam technologies specific to nuclear engineering. In addition, students will study experimental procedures through practical training as well as procedures for the safe handling of radioisotopes and radiation generators, methods for processing experimental data, and how to prepare scientific reports.

[Course objectives]

・ Cultivate familiarity with experimental procedures and a sense of engineering best practices.

・ Acquire basic knowledge and skills related to science and engineering with a mind towards practical application.

・ Cultivate the ability to acquire and utilize basic knowledge and technology related to nuclear engineering.

・ Learn how to conduct experiments while considering personal and environmental safety.

・ Cultivate the ability to work effectively, independently, and continuously on various tasks.

[Course schedule and contents]

Course will cover the following themes. Some of the themes also serve as new instruction and training regarding the handling of radioisotopes.
The order of lectures differs for each experimental group, and the content of corresponding exercises may change.

Lecture 1: Overview of experiments: Provide an overview of each experimental task, text distribution, pre-learning instructions and precautions, etc. will be given as necessary.

Lecture 2: Basics of creating engineering reports: Lecture will focus on creating experimental reports, as well as exercises to learn the basics of creating experimental reports.

Lecture 3: Radioactive isotope (RI) safety training seminar: Students will learn safe procedures for handling RIs. Students will study safe procedures for handling nuclear fuel materials.

Lecture 4: Plan drafting: Exercises and lectures on basic aspects of plan drafting.

Continue to 原子核工学実験 1 (2)↓↓↓

エネルギー応用工学設計演習・実験 1 (2)

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

原子核工学実験 1 (2)

Lecture 5: Equipment safety training: Students will learn about safety when handling machine tools such as drilling machines and lathes.

Lecture 6: Electronic safety training: Students will assemble various circuits and learn safe and reliable circuit manufacturing techniques.

Lecture 7: α -ray absorption: Students will learn about α -ray identification using semiconductor detectors and energy absorption, range, and straggling using α -ray-emitting substances.

Lecture 8: Absorption of β and γ -rays: Students will study procedures for the safe handling of RIs through experiments on energy absorption by β and γ -ray-emitting substances.

Lecture 9: X-ray diffraction: Using a powder X-ray diffractometer, students will learn the basic properties of X-rays and gain an understanding of the relationship between diffraction patterns and crystal structures.

Lecture 10: Atmospheric PIXE/PIGE analysis: Students will discharge a proton beam into the atmosphere and observe its range. In addition, the characteristic X-rays and γ -rays generated by various irradiating materials will be measured and trace element analysis will be performed as a study of the properties of ion beams and their use.

Lecture 11: Circuit meter training: Students will learn the operating principles and usage of analog and digital testers.

Lecture 12: Study of oscilloscopes and linear circuits: Students will learn how to use an oscilloscope, an essential tool for observing pulse waveforms as well as how to transmit pulses when they enter the network.

Lecture 13: Analog/digital circuits: Students will learn about the basics of amplifiers and digital circuits with semiconductor elements by actually creating circuits.

Lecture 14: Electron beams/vacuums: Students will focus an electron beam by electric and magnetic fields to learn the functions of electrostatic and magnetic lenses and understand the fundamental principles of vacuum technology.

Lecture 15: Report check: Confirmation of the content of students' submitted reports and provision of guidance regarding resubmission of deficient reports to confirm learning achievement.

[Course requirements]

N/A

[Evaluation methods and policy]

Students will prepare a report for each task, and performance will be evaluated on a scale of 1 to 3 with respect to the degree of achievement of each learning objective, and the total score is converted into a score out of 100.

Note that completing all assignments and submitting reports is a prerequisite for receiving credit.

Reports submitted late may be penalized, and messy or incomplete reports may require correction and resubmission.

Continue to 原子核工学実験 1 (3)↓↓↓

原子核工学実験 1 (3)

[Textbooks]

Texts and reference materials will be distributed for each experimental theme.

[References, etc.]

（**Reference books**）
Other materials will be introduced as needed for each experimental theme.

[Study outside of class (preparation and review)]

Submit reports on all experimental themes within the deadline.

In addition, follow the instructions in the experiment outline description for each experiment theme.

（**Other information (office hours, etc.)**）

The method of contacting the faculty in charge of each experimental theme will be given in the instructional material for each experiment.
Taking this course together with Nuclear Engineering Experiment 2 is desirable.

*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
・RI主任者【工学部の事業所（宇治）におけるRI管理の実務経験】

(3) Details of practical classes delivered based on instructors' practical work experience
・RI管理の経験に基づく実務的な教育が行われている。

エネルギー応用工学設計演習・実験 2 (2)

[Course schedule and contents]

,6times,
,6times,
,6times,
,6times,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45161 LJ71		
Course title (and course title in English)	エネルギー応用工学設計演習・実験２ Design Practice and Experiments for Applied Energy Science and Engineering 2	**Instructor's name, job title, and department of affiliation**	Graduate School of Energy Science Associate Professor,OKUMURA HIDEYUKI Graduate School of Energy Science Associate Professor,ABE MASATAKA Graduate School of Energy Science Associate Professor,HACHIYA KAN Graduate School of Energy Science Assistant Professor,IKENOUE TAKUMI Graduate School of Energy Science Professor,IMATANI SHIYOUJI Graduate School of Energy Science Associate Professor,IMADERA KENJI Graduate School of Energy Science Assistant Professor,OGAWA TAKAYA Graduate School of Energy Science Professor,KASHIWAYA YOSHIAKI Graduate School of Energy Science Associate Professor,KINOSHITA KATSUYUKI Graduate School of Energy Science Associate Professor,HASEGAWA MASAKATSU Graduate School of Energy Science Associate Professor,Jun HAYASHI Graduate School of Energy Science Assistant Professor,HORIBE NAOTO Graduate School of Energy Science Associate Professor,MATSUMOTO KAZUHIKO Graduate School of Energy Science Associate Professor,MIYAKE MASAO
Target year	3rd year students or above	**Number of credits**	3
Year/semesters	2020/Second semester		
Days and periods	Wed.3,4,Thu.3,4	**Class style**	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

Continue to エネルギー応用工学設計演習・実験 2 (2)↓↓↓

未更新

Course number	U-ENG26 36114 LJ72　U-ENG26 36114 LJ71		
Course title (and course title in English)	原子核工学実験２ Nuclear Engineering Laboratory 2	**Instructor's name, job title, and department of affiliation**	Graduate School of Engineering ALL STAFF Graduate School of Engineering Associate Professor,TASAKI SEIJI
Target year	3rd year students or above	**Number of credits**	3
Year/semesters	2020/Second semester		
Days and periods	Thu.1,2,3,4	**Class style**	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

Basic knowledge of a wide range of scientific and engineering fields (e.g. physics, chemistry, biology, electrical engineering, mechanical engineering, materials engineering) that form the basis of nuclear engineering, as well as basic proficiency with standards related to radiation and quantum beam technologies specific to nuclear engineering. In addition, students will study practical experimental procedures through practical training as well as procedures for the safe handling of radioisotopes and radiation generators, methods for processing experimental data, and how to prepare scientific reports.

[Course objectives]

・ Cultivate familiarity with experimental procedures and a sense of engineering best practices.

・ Acquire basic knowledge and skills related to science and engineering with a mind towards practical application.

・ Cultivate the ability to acquire and utilize basic knowledge and technology related to nuclear engineering.

・ Learn how to conduct experiments while considering personal and environmental safety.

・ Cultivate the ability to work effectively, independently, and continuously on various tasks.

[Course schedule and contents]

Course will cover the following themes.
The order of lectures differs for each experimental group, and the content of corresponding exercises may change.

Lecture 1: Overview of experiments: Provide an overview of each experimental task, text distribution, pre-learning instructions and precautions, etc. will be given as necessary.

Lecture 2: Basics of creating engineering reports: Lecture will focus on creating experimental reports, as well as exercises to learn the basics of creating experimental reports.

Lecture 3: Slow neutron beams: Students will measure neutrons from radioisotopes using a neutron counter to learn about the properties of neutrons and their interaction with matter.

Lecture 4: Radiochemistry: Students will learn how to handle unsealed radioactive materials using radioisotope (59Fe) and solvent extraction.

Continue to 原子核工学実験 2 (2)↓↓↓

未更新

Course number	U-ENG27 37135 EJ61		
Course title (and course title in English)	材料強度学 Strength and Fracture of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,SUMIGAWA TAKASHI
Target year	4th year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

原子核工学実験２(2)

Lecture 5: Ion beam generation and RBS analysis: Students will learn about ion beam technology, vacuum technology, analytical principles, etc. through particle accelerator maneuvering, and will attempt Rutherford backscattering analysis as an applied experiment using ion beams.

Lecture 6: Thermofluid measurement and boiling heat transfer: Students will conduct experiments utilizing boiling to deepen understanding of boiling and critical heat flux, and to learn basic measurement methods used in thermofluid engineering.

Lecture 7: Uranium chemistry: Lectures will focus on the separation of uranium thorium radiative equilibrium solutions (ion exchange, oxidation-reduction reaction) and will perform colorimetric quantitative analysis as study of the handling of nuclear fuel.

Lecture 8: Materials testing/electron microscopy: Students will perform tensile testing on various materials and obtain basic knowledge on the strength of metallic materials by analyzing pulling speed, etc.

Lecture 9: Radiation detection: Students will attempt detection of γ -rays emitted from substances existing in nature by using a Ge semiconductor detector as well as the identification and quantification of emitted nuclides. Students will also deepen their understanding of radiation and radioactive materials by measuring contamination using a survey meter and by measuring the decay process of nearby radioisotopes.

Lecture 10: Nonlinear Optical Effect Lasers: Students will perform laser oscillation experiments using an optical cavity and a solid crystal as study of the basic concepts related to stimulated emission. Students will also observe the generation of secondary harmonic waves using a nonlinear optical crystal, learn about phase matching, and study the basics of optical technology.

Lecture 11: Analog/digital measurement: Students will study the characteristics of analog and digital measurements, as well as the principles of impedance matching and sampling, by actually creating circuits in practice.

Lectures 12 and 13: Simulation experiments: Students will study the basics of computer simulations, and perform a simulated experiment on radiation permeation using Excel.

Lectures 14 and 15: Report check: Confirmation of the content of students' submitted reports and provision of guidance regarding resubmission of deficient reports to confirm learning achievement.

[Course requirements]

N/A

[Evaluation methods and policy]

Students will prepare a report for each task, and performance will be evaluated on a scale of 1 to 3 with respect to the degree of achievement of each learning objective, and the total score is converted into a score out of 100.

Note that completing all assignments and submitting reports is a prerequisite for receiving credit.

Reports submitted late may be penalized, and messy or incomplete reports may require correction and resubmission.

Continue to 原子核工学実験２(3)↓↓↓

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25164 LJ75		
Course title (and course title in English)	熱力学１（機宇：学番奇数） Thermodynamics 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKABE KAZUYOSHI Graduate School of Engineering Associate Professor,TATSUMI KAZUYA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

原子核工学実験２(3)

[Textbooks]

Texts and reference materials will be distributed for each experimental theme.

[References, etc.]

（**Reference books**）

Other materials will be introduced as needed for each experimental theme.

[Study outside of class (preparation and review)]

Submit reports on all experimental themes within the deadline.

In addition, follow the instructions in the experiment outline description for each experiment theme.

（Other information (office hours, etc.)）

The method of contacting the faculty in charge of each experimental theme will be given in the instructional material for each experiment.
Taking this course together with Nuclear Engineering Experiment 1 is desirable.

*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
・RI主任者【工学部の事業所（宇治）におけるRI管理の実務経験】

(3) Details of practical classes delivered based on instructors' practical work experience
・RI管理の経験に基づく実務的な教育が行われている。

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,5times,
,2times,
,2times,
,4times,
,1time,
,1time,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25164 LJ75		
Course title (and course title in English)	熱力学 1 （機宇：学番偶数） Thermodynamics 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,YOSHIDA HIDEO Graduate School of Engineering Professor,IWAI HIROSHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

0

[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.

熱力学 1 （エネ原）(2)

Based on test results, critical reviews will be made of student work.

[Course requirements]

The fundamental calculus as taught by the Institute of Liberal Arts and Science is a prerequisite for this course.

[Evaluation methods and policy]

Written examination

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

Thermodynamics and statistical mechanics (A. Harajima, Baifukan) (in Japanese). isbn{}{9784563021399}

[Study outside of class (preparation and review)]

After each class, students should spend time to review the equations and its derivations and understand the meaning.

（Other information (office hours, etc.)）

Depending on the number of course classes scheduled for each school year and other factors, a portion of the Syllabus may be omitted, or additions may be made thereto.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25164 LJ75		
Course title (and course title in English)	熱力学 1 （エネ原） Thermodynamics 1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,ISHIHARA KEIICHI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

In this course, Thermodynamics 1, the basic laws of thermodynamics are introduced. Also discussed are fundamental items including state changes of ideal and real gases, cycles, flow of gases, phase transformation, free energy, phase equilibrium and the phase rule, single-component phase diagrams, etc.

[Course objectives]

Students will gain an understanding of the meaning and significance of the first and second laws of thermodynamics, fundamental concepts for thermodynamics. Students will also be able to quantitatively deal with changes in thermodynamic quantity that accompany state changes.

[Course schedule and contents]

Introduction to thermodynamics (1class)
History of thermodynamics, introduction of variables and units used in thermodynamics.

The first law of thermodynamics (2classes)
Explanation is provided of definition of heat, Quasi-static process, specific heat, enthalpy, ideal gas.

The second law of thermodynamics (2classes)
Explanation is made of reversible and irreversible process, Ideal cycle, Carnot cycle by ideal gas, introduction of entropy.

Thermal engine (3classes)
Discussion in these classes will include the free expansion/compression of gas, Otto cycle, Brayton cycle, Carnot cycle.

Free energy (3classes)
Explanation is made of free energy, Maxwell equations, Joule-Thompson's experiment.

Phase transformation (2classes)
Explanation is made regarding various items, including phase, first order phase transformation, metastable equilibrium, critical point, second order phase transportation.

Confirmation of extent of student learning (1class)
Confirmation is made, via practice problems and exercises, of the extent that students have learned the contents of this course.

Feedback (1class)

Continue to 熱力学 1（エネ原）(2)↓ ↓ ↓

未更新

Course number	U-ENG25 35165 LJ75		
Course title (and course title in English)	材料熱力学 1 （材） Thermodynamics of Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SUGIMURA HIROYUKI
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Wed.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 35166 LJ75		
Course title (and course title in English)	材料熱力学２（材） Thermodynamics of Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,UDA TETSUYA
Target year	2nd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Tue.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

Fundamental of thermodynamics,4times,Internal energy,enthalpy,heat capacity\Entropy and second law\Direction of system change
Chemical potential,3times,Extensive and intensive variable,chemical potential\Composition-dG diagram and chemical potential\Phase rule,phase equilibria\Ideal solution,Henrian standard state, activity
Phase diagrams,1time,Relationship between phase diagram and Gibbs energy\Invariant reaction in binary systems
Thermodynamcis for electrode and ion,2times,Electrode potential, electromotive force\Standard state for ion, Standard hydrogen electrode
Chemical potential diagrams,3times,Chemical potential diagrams for ternary systems\Electrode potential-pH diagram

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to 材料熱力学２（材）(2)↓↓↓

Course number	U-ENG26 46115 LJ72		
Course title (and course title in English)	量子無機材料学１（材） Electronic Structures of Inorganic Materials 1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TANAKA ISAO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Thu.2	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

Electron theory is essential for fundamental understanding of the relationship among properties, crystal structure and chemical composition in wide variety of inorganic crystals. This course provides an introduction to the basic electron theory to be used to describe the electronic structures of inorganic materials in general.

[Course objectives]

This course provides an introduction to the basic electron theory to be used to describe the electronic structures of inorganic materials in general.

[Course schedule and contents]

Introduction to quantum theory,3times,Description of electrons, Schroedinger equation
Electronic structures of isolated atoms,3times,hydrogen-like atoms, quantum numbers, many-electron atoms, self-consistent method, electron spin
Electronic structure of simple molecules,3times,molecular orbital method, homo/hetero nuclear diatomic molecules, chemical bondings
Electronic structures of crystals,4times,electronic structure of monoatomic crystals and binary compounds, 1D chain of hydrogen atoms, Bloch theorem, band calculations
Application to materials science,1time,Density functional theory calculations and their application to materials science
Assessment of mastery of the course content,1time,Assessment of mastery of the course content

[Course requirements]

Understanding of contents for Basic Phys. Chemistry(quantum theory) is preferred.

[Evaluation methods and policy]

Final exam.
Some quiz-sheets are distributed at the lecture whose answers should be submitted on site. Their scores may count as a portion (20%) of the cumulative grade.

Continue to 量子無機材料学１（材）(2)↓↓↓

材料熱力学２（材）(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.

量子無機材料学１（材）(2)

[Textbooks]

Isao TANAKA and others 『(In Japanese) Introduction to electron theory of materials』 ISBN:10: 9784753655595
The textbook for this lecture (in Japanese) can be purchased at a bookstore.

[References, etc.]

（**Reference books**）
Frank L. Pilar 『Elementary Quantum Chemistry』 ISBN:10: 0486414647
Mark Weller, Tina Overton, Jonathan Rourke 『Inorganic Chemistry 』ISBN:10: 0198768125
Peter Atkins, Julio de Paula, James Keeler 『Atkins' Physical Chemistry』 ISBN:10: 0198769865
Neil W. Ashcroft 『Solid State Physics』 ISBN:10: 8131500527
Anthony R. West 『Solid State Chemistry and its Applications 』ISBN:10: 1119942942
Richard M. Martin 『Electronic Structure: Basic Theory and Practical Methods』 ISBN:10: 0521534402
Standard textbooks for elementary quantum physics, quantum chemistry, solid state chemistry and solid state physics may be used.

[Study outside of class (preparation and review)]

Support materials are available on KULASIS. Password is given in the lecture room.
They may be used for reviewing.

（Other information (office hours, etc.)）

Questions may be sent by e-mail.

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG23 33512 LE73		
Course title (and course title in English)	量子無機材料学２（材） Electronic Structures of Inorganic Materials 2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,SEKO ATSUTO

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Tue.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

It is important to understand the electronic structure of materials because of its determinantal impacts on material functions. This lecture gives the fundamentals of electronic structure calculations based on quantum chemistry and band theory. The relationship between the electronic structure of inorganic materials and their functions is also discussed.

[Course objectives]

Learning the fundamentals of quantum chemistry and band theory, and their applications to the issues in materials science.

[Course schedule and contents]

Electronic structure theory for materials science,1time,The roles of electronic structure theory in materials research and development.
Fundamentals of electronic structure theory,2times,The characteristics and physical meanings of wavefunctions, total energy, and one-electron energy.
Theory, approximations, and methods in quantum chemistry (1),4times,Variational method and perturbation method.
Theory, approximations, and methods in quantum chemistry (2),3times,Hartree and Hartree-Fock approximations in quantum chemistry.
Electronic band structure calculation,2times,Density functional theory, pseudopotential and basis set in electronic band structure calculation.
Electronic structure and chemical bonding of molecules and solids,2times,The electronic structure and chemical bonding of molecules and solids.
Assessment of mastery of the course content,1time,The mastery of the course content is assessed.

[Course requirements]

None

[Evaluation methods and policy]

Evaluations are made based on the examination. The results of quizzes and reports may be considered.

Continue to 量子無機材料学２（材）(2)↓↓↓

未更新

Course number	U-ENG26 46116 LJ57　U-ENG26 46116 LJ52		
Course title (and course title in English)	機械システム学セミナー（機） Seminar on Mechanical and System Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI Graduate School of Engineering Associate Professor,IZUI KAZUHIRO Graduate School of Engineering Professor,YOKOKAWA RYUUJI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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[Course requirements]

None

[Evaluation methods and policy]

Continue to 機械システム学セミナー（機）(2)↓↓↓

量子無機材料学２（材）**(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.

機械システム学セミナー（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG27 37312 EJ61　U-ENG27 37312 EJ76		
Course title (and course title in English)	マイクロ材料の加工・評価の基礎 Fabrication and analysis of micromaterials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TSUCHIYA TOSHIYUKI Graduate School of Engineering Professor,SUZUKI MOTOFUMI Graduate School of Engineering Professor,YOKOKAWA RYUUJI

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

Continue to マイクロ材料の加工・評価の基礎(2)↓↓↓

未更新

Course number	U-ENG26 26118 SJ72		
Course title (and course title in English)	知能システム工学（機） Intelligent Systems Engineering	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,SAWARAGI TETSUO Graduate School of Engineering Senior Lecturer,NAKANISHI HIROAKI

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,2times,
,2times,
,2times,
,2times,
,2times,
,2-3times,

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]

（**Reference books**）

Continue to 知能システム工学（機）(2)↓↓↓

マイクロ材料の加工・評価の基礎(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

知能システム工学（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
A course with practical content delivered by instructors with practical work experience

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

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

未更新

Course number	U-ENG26 36201 EJ72		
Course title (and course title in English)	材料科学基礎３ Fundamentals of Materials Science III	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TOYOURA KAZUAKI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

[Textbooks]

isbn{}{9784254240184}

[References, etc.]

（**Reference books**）

isbn{}{9784563067120} isbn{}{9784563067137}
D.A.Porter and K.E.Easterling: Phase Transformations in Metals and Alloys isbn{}{0412450305}

[Study outside of class (preparation and review)]

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

材料組織学(2)

[Evaluation methods and policy]

Evaluation method: Evaluation will be based on one written examination at the end of semester.
Evaluation standard: The result of a written examination should be 60 and above out of 100. (60 and above: Passed, 59 and below: Failed)
Evaluation may include short reports.

[Textbooks]

松原英一郎他 『金属材料組織学』（朝倉書店）ISBN:9784254240184

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Students are required to carry out a review of class.

（**Other information (office hours, etc.)**）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG26 36202 PJ72		
Course title (and course title in English)	材料組織学 Fundamentals of Microstructure of Materials	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,HIDEYUKI YASUDA

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Mon.1	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Physical and chemical properties of materials depend on not only lattice structure and composition but also microstructure. In this lecture, the microstructure evolution during phase transformation (i.e. solidification) will be explained by using thermodynamics and kinetics (atomic diffusion, thermal energy transport and momentum transport). Students study the fundamentals of microstructure evolution (nucleation, growth mechanism, solute partition, microstructure selection, dendritic growth, eutectic growth and equilibrium / non-equilibrium processes).

[Course objectives]

1. To understand relationship between microstructure evolution and thermodynamics / kinetics.
2. To be able to use thermodynamics and kinetics for understanding microstructure in materials.

[Course schedule and contents]

1. Introduction (1): fundamentals of thermodynamics and kinetics, which are required for understanding this class
2. Nucleation (1): classical nucleation theory and curvature effect
3. Interface morphology (1): interface morphology (atomic scale), macroscopic interface shape
4.Growing interface (3): local equilibrium at interface, solute partition, stability of interface
5.Dendritic growth (2): mechanism of dendritic growth, selection mechanism
6.Solute partition and segregation (2): solute partition at interface, segregation (non-uniform distribution of solutes)
7.Eutectic growth (1): cooperative growth (eutectic growth) of multiple phases, selection of microstructure
8.Non-equilibrium phase transformation (1): rapid solidification, non-equilibrium and metastable phases
9. Microstructure evolution (2): relationship between microstructure evolution and phase diagram, selection rules in phase transformation
10. Learning achievement evaluation, and feedback (1)

[Course requirements]

Fundamentals of Microstructure of Materials 1,2 and 3

Continue to 材料組織学(2)↓↓↓

Course number			
Course title (and course title in English)	放射線計測学 Radiation detection and measurement	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Associate Professor,TSUCHIDA HIDETSUGU

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Wed.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

放射線（イオンや電子などの荷電粒子線、Ｘ線やγ線などの光子線、中性子線）の計測法について、放射線と物質との相互作用、計測に用いる各種放射線検出器の動作原理や計測技術等を述べる。本講義の目的は、様々な分野への放射線利用において放射線計測の重要性を理解することである。

[Course objectives]

放射線の性質及び物質との相互作用に関する基本的事項と放射線検出器の基本的な動作原理や測定技術を理解することにより、放射線の安全な取扱い等について学修する。

[Course schedule and contents]

（１）放射線計測の概要【1週】
本講義の全体的な概要を説明する。具体的には、放射線の性質、放射線計測の概要（測定の種類や計測回路の基本構成）、検出器の概要及び放射線計測で用いる単位などについて説明する。

（２）光子線の性質【1週】
光子線（Ｘ線・γ線）の性質及び物質との相互作用（相互作用過程とその断面積、減衰など）に関連した基本的事項を説明する。

（３）荷電粒子線の性質【1週】
荷電粒子（イオン、電子）の性質及び物質との相互作用（相互作用過程、エネルギー損失、飛程など）に関連した基本的事項を説明する。

（４）中性子線の性質【1週】
中性子の性質、物質との相互作用（相互作用過程、核反応など）に関連した基本的事項を説明する。

（５）放射線検出器【4週】
放射線検出器（ガス入り検出器、半導体検出器、シンチレーション検出器、その他の検出器）の基本的な動作原理を述べるとともに、放射線の種類に応じた検出器の検出原理及び基本特性等を解説する。

（６）放射線計測技術【1週】
放射線計測の基本構成（放射線のエネルギー計測や時間計測をする場合の構成など）、計測回路（モジュールの種類とその役割）及び計測回路の信号処理などについて説明する。

（７）放射線のスペクトルの測定【2週】
荷電粒子線、γ線、中性子線などのエネルギースペクトルの代表的な測定法について説明する。

Continue to 放射線計測学(2)↓↓↓

放射線計測学(2)

（８）放射線計測の定量【1週】
放射線計測の定量に関わる基本的事項について解説する。具体的には、絶対測定と相対測定との違い、検出効率、立体角などを説明する。

（９）放射線計測における統計【2週】
放射線計測に用いる統計学（確率分布及び誤差伝播など）を説明する。

（１０）総括【1週】
本講義の全体のまとめを行うとともに、放射線計測を基礎とした放射線の安全な取扱いについて考察する。

[Course requirements]
原子物理学

[Evaluation methods and policy]
筆記試験の成績により評価する。

[Textbooks]
特に定めない

[References, etc.]
（**Reference books**）
ニコラス・ツルファニディス著　阪井英次訳　放射線計測の理論と演習（上、下巻）現代工学社など ibid{}{TW86012413} ibid{}{BB01056431}

[Study outside of class (preparation and review)]
講義中に配布する演習問題及び参考書等を用いて行う。

（Other information (office hours, etc.)）
必要に応じてプリントを配布する。

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 25300 LJ71　U-ENG25 25300 LJ77		
Course title (and course title in English)	原子炉物理学（原） Nuclear Reactor Physics	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,KANNO IKUO
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/First semester		
Days and periods	Fri.1	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]
,4times,
,4times,
,3times,
,3times,
,1time,

[Course requirements]
None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]
（**Reference books**）

Continue to 原子炉物理学（原）(2)↓↓↓

未更新

Course number	U-ENG27 37404 LJ61		
Course title (and course title in English)	高分子材料概論（材） Introduction to Polymer Materials	Instructor's name, job title, and department of affiliation	Part-time Lecturer,Part-time Lecturer
Target year	3rd year students or above	Number of credits	2
Year/semesters	2020/Second semester		
Days and periods	Mon.3	Class style	Lecture
Language of instruction	Japanese		

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]
,1time,
,3times,
,4times,
,4times,
,2times,
,1time,

[Course requirements]
None

[Evaluation methods and policy]

[Textbooks]

[References, etc.]
（**Reference books**）

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）
*Please visit KULASIS to find out about office hours.

原子炉物理学（原）**(2)**

[Study outside of class (preparation and review)]

（Other information (office hours, etc.)）
*Please visit KULASIS to find out about office hours.

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

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

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

未更新

Course number	U-ENG27 37133 LJ60		
Course title (and course title in English)	結晶回折学（材） Xray Diffraction	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,OKUDA HIROSHI

Target year	3rd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Fri.2	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

Structural analyses by X-ray diffraction method will be given. In the lecture, the properties of X-rays, X-ray diffraction phenomena, crystallography, and diffraction by powder samples will be lectured.

[Course objectives]

Students will learn the crystal structure analyses by X-rays through the course works of X-ray properties, crystalline structures, diffraction conditions, and reciprocal lattices.

[Course schedule and contents]

Basic properties of x-rays,3times,1.X-rays\2.Continuous x-rays\3.Characteristic x-rays\4.X-ray absorption\5. X-ray filter\6.Generation of x-rays
Crystallography,3times,1.One dimensional crystal symmetry\2.7 crystal systems and 14 Bravais#039 lattices\ 3. Practical examples of crystals\4. Body-centered cubic, face-centered cubic and hexagonal close-packed lattices\6. Crystalline structures of several compounds
Description of crystal planes and directions,1time,1. Description of lattice planes and directions\2. Stereo projection
Diffraction by crystals,3times,1. Diffraction by crystalline lattice\2. Bragg conditions and scattering angle\3. Calculation of structure factors
Diffraction by a powder sample,1time,1. Principle of diffractometer\2. X-ray diffraction by powder sample
Structural analyses of cubic systems,time,1. Determination of a lattice parameter in cubic systems\2. Determination of Bravais#039 lattice in cubic systems
Reciprocal lattice and diffraction condition,3times,1. Definition of reciprocal lattices\2. Reciprocal lattice and real lattice\3. Reciprocal lattice and diffraction condition

[Course requirements]

None

[Evaluation methods and policy]

The course will be evaluated from the scores of a midterm examination (40%) and a final examination (60%).

Continue to 結晶回折学（材）(2)↓↓↓

未更新

Course number			
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,MORIKURA MASAHIRO

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,2times,
,5times,
,2times,
,5times,
,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.

結晶回折学（材）(2)

[Textbooks]

Instructed during class

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

Concentrate on a lecture, and review the contents which you got by a lecture by rearanging your lecture note and studying any questions of lecture contents for at least 4 hours in each lecture.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（機） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、機械工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査、報告
１０～１２回
設定課題の新規性、独創性等の検討
１３～１５回
研究計画の立案

[Course requirements]

物理工学科機械システム学コースが指定する、入学年次に対応した特別研究着手条件を満たしていること。

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況に基づいて行う。

[Textbooks]

配属研究室で指定される。

[References, etc.]

（**Reference books**）
木下是雄 『理科系の作文技術』（中央公論新社 (新書)）ISBN:9784121006240

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（材） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、材料科学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査、報告
１０～１２回
設定課題の新規性、独創性等の検討
１３～１５回
研究計画の立案

上記の研究活動を４単位分実施するとともに、特別研究報告書の執筆指導などを行う。

[Course requirements]

物理工学科材料科学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、出席状況に基づいて行う。

[Textbooks]

指導教員が個別に指示する教科書等を利用する

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（原） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、原子核工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回　研究課題の設定
５～９回　先行研究の調査、報告
１０～１２回　設定課題の新規性、独創性等の検討
１３～１５回　研究計画の立案

[Course requirements]

物理工学原子核工学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
各指導教員が紹介する

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（エネ） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、エネルギー応用工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査、報告
１０～１２回
設定課題の新規性、独創性等の検討
１３～１５回
研究計画の立案

[Course requirements]

物理工学科エネルギー応用工学コースが指定する入学年次の特別研究着手条件を満たしていること。

[Evaluation methods and policy]

一連の研究活動の実施状況に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（宇） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKATA SHIGERU

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと，航空宇宙工学の関連分野（航空宇宙力学，流体力学，流体数理学，推進工学，制御工学，機能構造力学，分子流体力学）に関する研究課題を設定し，その課題解決のための研究活動を主体的に取り組む．この研究活動を通じて課題解決能力を習得する．得られた成果を関連研究と比較し，その意義や重要性等についてまとめる能力を養う．

[Course objectives]

課題設定，関連研究の調査，研究計画の立案，報告の作成などを通じて，研究活動について学ぶ．

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査，報告
１０～１２回
設定課題の新規性，独創性等の検討
１３～１５回
研究計画の立案

[Course requirements]

物理工学科宇宙基礎工学コースが指定する入学年次の特別研究着手条件を満たしていること．

[Evaluation methods and policy]

一連の研究活動の実施状況に基づいて行う．

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
各担当教員から研究テーマに応じて指示する．

[Study outside of class (preparation and review)]

指示された参考書および学術論文等を学期をかけて読み進めること．

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（材） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、材料科学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査、報告
１０～１２回
設定課題の新規性、独創性等の検討
１３～１５回
研究計画の立案

上記の研究活動を４単位分実施するとともに、特別研究報告書の執筆指導などを行う。

[Course requirements]

物理工学科材料科学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、出席状況に基づいて行う。

[Textbooks]

指導教員が個別に指示する教科書等を利用する

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（原） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、原子核工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回　研究課題の設定
５～９回　先行研究の調査、報告
１０～１２回　設定課題の新規性、独創性等の検討
１３～１５回　研究計画の立案

[Course requirements]

物理工学科原子核工学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
各指導教員が紹介する

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45995 GJ77		
Course title (and course title in English)	特別研究１（エネ） Graduation Thesis1	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI

Target year	4th year students or above	Number of credits	4	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、エネルギー応用工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、報告の作成などを通じて、研究活動について学ぶ。

[Course schedule and contents]

１～４回
研究課題の設定
５～９回
先行研究の調査、報告
１０～１２回
設定課題の新規性、独創性等の検討
１３～１５回
研究計画の立案

[Course requirements]

物理工学科エネルギー応用工学コースが指定する入学年次の特別研究着手条件を満たしていること。

[Evaluation methods and policy]

一連の研究活動の実施状況に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究2（機） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NISHIWAKI SHINJI

Target year	4th year students or above	Number of credits	6	Year/semesters	2020/Intensive, Second semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、機械工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回
設定課題の新規性、独創性等の再検証
２～１０回
実験または理論検討の実施、結果の考察、実験または理論検討の計画の修正などにより研究を遂行
１１～１３回
成果のまとめ、特別研究報告書の執筆、学士発表会のための資料作成
１４回
学士発表会での発表
１５回
特別研究報告書の訂正

[Course requirements]

物理工学科機械システム学コースが指定する、入学年次に対応する特別研究着手条件を満たしていること。また、特別研究１を履修済みであること。

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、学士発表会における発表内容、特別研究報告書の内容に基づいて行う。

[Textbooks]

各研究室において指定する。

[References, etc.]

（**Reference books**）
木下是雄『理科系の作文技術』（中央公論新社 (新書)）ISBN:9784121006240

Continue to 特別研究2（機）(2)↓↓↓

特別研究2（機）(2)

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

特別研究2（材）(2)

[Textbooks]

指導教員が個別に指示する教科書等を利用する

[References, etc.]

（Reference books）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究2（材） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI
Target year	4th year students or above	Number of credits	6
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

担当教員の指導のもと、材料科学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回
設定課題の新規性、独創性等の再検証
２～７回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
８～９回
成果のまとめ、中間発表のための資料作成
１０回
特別研究中間発表会での発表
１１～１３回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１４～１５回
特別研究報告書の執筆

上記の研究活動を６単位分実施するとともに、特別研究報告書の執筆指導などを行う。

[Course requirements]

物理工学科材料科学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、出席状況、中間発表会における発表内容、特別研究報告書の内容に基づいて行う。

Continue to 特別研究2（材）(2)↓↓↓

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究2（エネ） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI
Target year	4th year students or above	Number of credits	6
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

担当教員の指導のもと、エネルギー応用工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回
設定課題の新規性、独創性等の再検証
２～１０回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１１～１２回
成果のまとめ、中間発表のための資料作成
１３回
特別研究中間発表会での発表
１４～１５回
特別研究報告書の執筆

[Course requirements]

物理工学科エネルギー応用工学コースが指定する入学年次の特別研究着手条件を満たしていること。

[Evaluation methods and policy]

一連の研究活動の実施状況、中間発表会における発表内容、特別研究報告書の内容に基づいて行う。

Continue to 特別研究2（エネ）(2)↓↓↓

特別研究2（エネ）(2)

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究2（宇） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKATA SHIGERU
Target year	4th year students or above	Number of credits	6
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

担当教員の指導のもと，航空宇宙工学の関連分野（航空宇宙力学，流体力学，流体数理学，推進工学，制御工学，機能構造力学，分子流体力学）に関する研究課題を設定し，その課題解決のための研究活動を主体的に取り組む．この研究活動を通じて課題解決能力を習得する．得られた成果を関連研究と比較し，その意義や重要性等についてまとめる能力を養う．

[Course objectives]

課題設定，関連研究の調査，研究計画の立案，実験（シミュレーション含む）と検証を行う．これらの成果を特別研究としてまとめ，発表することを通じて，研究活動について学ぶ．

[Course schedule and contents]

１回
設定課題の新規性，独創性等の再検証
２～１０回
実験の実施，結果の考察，実験計画の修正などにより研究を遂行
１１～１２回
成果のまとめ，発表のための資料作成
１３回～１５回
特別研究の発表と報告書の執筆

[Course requirements]

物理工学科宇宙基礎工学コースが指定する入学年次の特別研究着手条件を満たし，特別研究１（宇）を修得していること．

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況，報告会における発表内容，特別研究報告書の内容に基づいて行う．

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
各担当教員から研究テーマに応じて指示する．

Continue to 特別研究2（宇）(2)↓↓↓

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究2（原） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI
Target year	4th year students or above	Number of credits	6
Year/semesters	2020/Intensive, Second semester		
Days and periods	Intensive	Class style	Seminar
Language of instruction	Japanese		

[Overview and purpose of the course]

特別研究１の成果を踏まえ、担当教員の指導のもと、原子核工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回　設定課題の新規性、独創性等の再検証
２～１０回　実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１１回　成果のまとめ
１２～１４回　特別研究報告書の執筆
１５回　特別研究報告会での成果発表(ポスター発表)

[Course requirements]

物理工学科原子核工学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、特別研究報告書の内容、特別研究報告会(ポスター発表)における発表内容に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

特別研究2（宇）(2)

[Study outside of class (preparation and review)]

指示された参考書および学術論文等を学期をかけて読み進めること．

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究２（材） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,NAKAMURA HIROYUKI

Target year	4th year students or above	Number of credits	6	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、材料科学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回
設定課題の新規性、独創性等の再検証
２～７回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
８～９回
成果のまとめ、中間発表のための資料作成
１０回
特別研究中間発表会での発表
１１～１３回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１４～１５回
特別研究報告書の執筆

上記の研究活動を６単位分実施するとともに、特別研究報告書の執筆指導などを行う。

[Course requirements]

物理工学科材料科学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、出席状況、中間発表会における発表内容、特別研究報告書の内容に基づいて行う。

Continue to 特別研究２（材）(2)↓↓↓

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究２（エネ） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Energy Science Professor,IMATANI SHIYOUJI

Target year	4th year students or above	Number of credits	6	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

担当教員の指導のもと、エネルギー応用工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回
設定課題の新規性、独創性等の再検証
２～１０回
実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１１～１２回
成果のまとめ、中間発表のための資料作成
１３回
特別研究中間発表会での発表
１４～１５回
特別研究報告書の執筆

[Course requirements]

物理工学科エネルギー応用工学コースが指定する入学年次の特別研究着手条件を満たしていること。

[Evaluation methods and policy]

一連の研究活動の実施状況、中間発表会における発表内容、特別研究報告書の内容に基づいて行う。

Continue to 特別研究２（エネ）(2)↓↓↓

特別研究２（材）(2)

[Textbooks]

指導教員が個別に指示する教科書等を利用する

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

特別研究２（エネ）(2)

[Textbooks]

Not used

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと。

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

Course number	U-ENG25 45998 GJ77		
Course title (and course title in English)	特別研究２（原） Graduation Thesis2	Instructor's name, job title, and department of affiliation	Graduate School of Engineering Professor,TAKAGI IKUJI Graduate School of Engineering Associate Professor,TAISHI KOBAYASHI

Target year	4th year students or above	Number of credits	6	Year/semesters	2020/Intensive, First semester
Days and periods	Intensive	Class style	Seminar	Language of instruction	Japanese

[Overview and purpose of the course]

特別研究１の成果を踏まえ、担当教員の指導のもと、原子核工学に関する研究課題を設定し、その課題解決のための研究活動を主体的に取り組む。この研究活動を通じて課題解決能力を習得する。得られた成果を関連研究と比較し、その意義や重要性等についてまとめる能力を養う。

[Course objectives]

課題設定、関連研究の調査、研究計画の立案、実験と検証を行う。これらの成果を特別研究としてまとめ、発表することを通じて、研究活動について学ぶ。

[Course schedule and contents]

１回　設定課題の新規性、独創性等の再検証
２～１０回　実験の実施、結果の考察、実験計画の修正などにより研究を遂行
１１回　成果のまとめ
１２～１４回　特別研究報告書の執筆
１５回　特別研究報告会での成果発表(ポスター発表)

[Course requirements]

物理工学科原子核工学コースが指定する入学年次の特別研究着手条件を満たしていること

[Evaluation methods and policy]

成績評価は一連の研究活動の実施状況、特別研究報告書の内容、特別研究報告会(ポスター発表)における発表内容に基づいて行う。

[Textbooks]

Not used

[References, etc.]

（**Reference books**）
Introduced during class

[Study outside of class (preparation and review)]

各指導教員の指示に従うこと

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number	U-ENG29 39028 LJ10　U-ENG29 39028 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 Associate Professor,YOSHIKAWA HITOSHI

Target year	2nd year students or above	Number of credits	2	Year/semesters	2020/Second semester
Days and periods	Wed.3	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

[Course objectives]

[Course schedule and contents]

,1time,
,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.

未更新

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

Target year	1st year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Tue.5	Class style	Lecture	Language of instruction	Japanese

[Overview and purpose of the course]

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

[Course objectives]

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

[Course schedule and contents]

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

[Course requirements]

None

[Evaluation methods and policy]

Reports and examinations

[Textbooks]

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

[References, etc.]

（**Reference books**）

[Study outside of class (preparation and review)]

After the lesson, solve problems in the text.

（Other information (office hours, etc.)）

*Please visit KULASIS to find out about office hours.

未更新

Course number			
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 Associate Professor,YOSHIKAWA HITOSHI

Target year	4th year students or above	Number of credits	2	Year/semesters	2020/First semester
Days and periods	Thu.4	Class style	Lecture	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]

[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.