

# 2019-2020 Syllabus

Future University Hakodate  
Graduate School of  
Systems Information Science

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Dividend Year, Credits and Instruction Language of Class

(講義科目の配当年次, 単位数および教授言語)

# Academic Literacy in Context 1 (システム情報科学におけるアカデミックリテラシー I)

Grade	Master's 1st grade
Semester	1st
Credits	2
Instructor	Atsuko Tominaga

## 1. Course Outline

Graduate students must write theses and research papers. In this course, students will learn the academic literacy necessary to write these papers (how to collect related literatures and how to manage them, reading skills, and writing skills). Moreover, students also learn research ethics that must be kept as researchers. Each lesson consists of lectures, personal work, group work, and peer review.

## 2. Keywords

Literature review, Reading, Writing, Research Ethics

## 3. Course Objectives

- To read articles (about ten pages) of own research field and write the summary.
- To write own research report.
- To check each other's reports.
- To understand Research ethic and act while being conscious of it.

## 4. Course Schedule

Week 1: Orientation (course summary, how to study, and assessment).

Week 2: How to search and manage the documents related own study.

Week 3-4: Reading (speed reading and intensive reading). How to write summary.

Week 5-6: References and citations. Plagiarism prevention.

Week 7-10: Writing skill.

Week 11-13: How to write introduction, method, result, and discussion.

Week 14: Research ethic

Week 15: Conclusion

## 5. Prior/Post Assignment

Prior: Textbook preparations, solving practice problems.

Post: Assignment.

## 6. Assessment

Assignment (30%), Midterm test (30%), Final test (40%)

## 7. Textbooks

酒井聡樹(2006)これから論文を書く若者のために 大改訂増補版. 共立出版

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Academic Literacy in Context 2 (システム情報科学におけるアカデミックリテラシーⅡ)

Grade	Master's 1st grade
Semester	2nd
Credits	2
Instructor	Michael Vallance

## 1. Course Outline

The course proceeds in a process-oriented manner in which students learn key concepts and techniques for effective, step-by-step writing. Students will be given opportunities to demonstrate and apply their learning through hands-on exercises, in-class discussion, planning and reflective activities, peer-reviewing and feedback. Some of the key concepts and techniques introduced in Academic Literacy 1 will be reviewed and reinforced with additional activities and examples relevant for the purpose of this course. The goal is to prepare students to become responsible experts in their own discipline, with integrity and attitudes that will support their future research activities in international settings. The instructor has a doctoral qualification and significant teaching and research experience.

## 2. Keywords

applying writing skills, evaluating research papers, organizing research, reflecting on learning

## 3. Course Objectives

Academic Literacy aims to assist beginning graduate students in implementing and writing about their research in English. The course provides an overview of conventional research papers with a special focus on the style and organizational characteristics, as well as the rationale and reasoning behind those conventions.

## 4. Course Schedule

Week 1: Introduction to Academic Literacy in Context

Week 2: Research processes: scientific method and engineering design

Week 3: Research plans as flowcharts

Week 4 - 5: Literature Review and Reading

Week 6: Referencing: IEEE style

Week 7: Research method: Proposed system/ implementation

Week 8 - 9: Research method: Procedure - the 'what, how and why' of your research

Week 10: Writing: Discussion/ Evaluation/ Expected outcomes

Week 11: Writing: Conclusion

Week 12: Writing: Introduction

Week 13: Writing: Abstract

Week 14: Final assignment peer reviewing.

Week 15: Final assignment submission.

## 5. Prior/Post Assignment

Prior: Prepare your Masters research content for personal use in all classes.

Post: Review the class activities and apply your learning to your personal Masters research.

## 6. Assessment

For the final assignment (30%), students are required to write an academic paper in English of their Masters research project. Mid-term assignments (Literature Review (30%); Method (30%); Reading (10%)) consist of the sections of the final assignment that are required in the writing process.

## 7. Textbooks

Academic Literacy course materials will be provided in paper-based and ePub format. Moodle for e-learning (activities and content) will be used.

## 8. Language of Instruction

English.

## 9. Requirements for registration

## 10. Note

Bring your own laptop to every class.

# Introduction to Basics of Systems Information Science (システム情報科学基礎概論)

Grade Master's 1st or 2nd grade  
Semester 1st or 2nd  
Credits 2  
Instructor Advisors,  
Graduate School  
Faculty Members

## 1. Course Outline

Depends on undergraduate courses to take.

## 2. Keywords

Systems Information Science, Society 5.0

## 3. Course Objectives

- Understand the basic knowledge regarding to the research theme.
- Conduent the research theme voluntarily.

## 4. Course Schedule

Depends on undergraduate courses to take.

## 5. Prior/Post Assignment

Depends on undergraduate courses to take.

## 6. Assessment

Grades are evaluated by each faculty member in charge of the course.

## 7. Textbooks

Depends on undergraduate courses to take.

## 8. Language of Instruction

Depends on undergraduate courses to take.

## 9. Requirements for registration

Select the course carefully according to your supervisor's instructions.

## 10. Note

# Experimental Design and Data Analysis (実験デザインとデータ解析)

Grade	Master's 1st or 2nd grade
Semester	2nd
Credits	2
Instructor	Edson T. Miyamoto

## 1. Course Outline

This is a hands-on class. Emphasis will be on analyzing data made available during lectures as well as students' own data when appropriate. Each student will also design, prepare and conduct an experiment as part of a course project. At each step, students will be required to simulate possible alternative scenarios of what they are about to do, anticipating problems and finding ways around them, so that they can more clearly link later outcomes to their earlier decisions and choices.

- Lectures may be conducted in English and/or Japanese depending on the students registered. Readings will be in English with optional materials in Japanese. (講義は英語、または、日本語で行うが、配布資料等は英語のものが多い。)
- Install R on your computer and bring it to every lecture.

## 2. Keywords

experimental design, data analysis, linear mixed-effects models

## 3. Course Objectives

This course covers experimental design and data analysis with the aim of making students more aware of the entire process of a research project. Students will plan each step of the way, so that they can consider in advance the drawbacks and tradeoffs of their decisions before collecting and analyzing the data.

## 4. Course Schedule

Weeks 1-2. Introduction to experimental design

- bottom-up or top-down: qualitative versus quantitative designs
- causality: experiments versus quasi-experiments
- independent variables, dependent variables, confounding factors
- one researcher's factor of interest is another researcher's confounding factor
- ethics: consent form, anonymity, participants' rights, ethics approval

Weeks 3-4. Data visualization on R

- trends, outliers, trimming

Weeks 5-6. Basic modeling on R

- modeling, model-based trimming

Weeks 7-12. Linear mixed-effects models on R

- random factors, model selection

Week 13. How to report results

- citing previous research: dues where dues are due

Weeks 14-15. Final presentation and overall considerations

- presentations, peer-review
- replications and where to go from here
- tradeoffs in the decisions made during experimental design

## 5. Prior/Post Assignment

- Example assignments: read materials in advance, analyze data,
- Project: design and prepare an experiment, then collect and analyze the data

## 6. Assessment

Evaluation will be based on in-class activities and a project of students' choice. The project cannot be the main topic of the students' theses.

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## **7. Textbooks**

There is no textbook for this class. Readings will be assigned along the semester, including portions of the following books.

- Baayen, R. H. (2008). *Analyzing Linguistic Data - A Practical Introduction to Statistics using R*. Cambridge University Press.
- Kirk, R. E. (2013). *Experimental Design: Procedures for the Behavioral Sciences*. Sage Publications.

## **8. Language of Instruction**

English and/or Japanese

## **9. Requirements for registration**

## **10. Note**

Install R on your computer and bring it to every lecture.  
<https://www.r-project.org/>



# Internship 1 (インターンシップ I)

Grade	Master's 1st or 2nd grade
Semester	1st or 2nd
Credits	2
Instructor	Advisors, Head of Graduate School

## 1. Course Outline

Students participate in the research/working program provided by outside organizations including companies and research institutes for a certain period, submit the report about the result to the graduate school education affairs committee. They earn 2 credits when the committee admit the result is equivalent to a course for 1 semester.

## 2. Keywords

Training, Internship for research, Outside organization

## 3. Course Objectives

Internships aim that students learn various viewpoints and knowledge including relationship with the society through the research/working training outside of school including companies and research institutes to develop their researches wider and deeper through the experience. (evaluated based on plan and results)

## 4. Course Schedule

1. (Selection and application for participating program)

Students select participating program consistent with the abovementioned contents and obtain permission of their advisors. They need to submit "internship plan" to the graduate school education affairs committee through the advisors in advance of the program.

2. (Participation in program)

Students conduct research/working activities following by the direction of the companies providing the internship program.

3. (Submission of report)

Students submit following documents to the graduate school education affairs committee through the administration bureau after the program:

(1) "Internship report" written by students (with specified format.

(2) "Internship evaluation" issued by the organization provided the program (with arbitrary format)

## 5. Prior/Post Assignment

Prior: Students should consult their supervisors and understand the contents and precautions of this course. Further, understand the significance of this subject and prepare internship plan.

Post: Students review the internship achievements and various other things they have learned, and prepare internship reports.

## 6. Assessment

Grades are determined by the graduate school education affairs committee that evaluated the contents of the submitted documents.

## 7. Textbooks

None.

## 8. Language of Instruction

Depends on the plan.

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**9. Requirements for registration**

- The research/working program is not only the one recommended by the advisors and graduate school committee meeting, but also the one students select by themselves. In either case permission of the advisors are required beforehand to participate in the program.
- The internship program must be the research/training activities consistent with the purpose of the course. The programs aiming at job and social experiences are excluded.
- The period of the program shall be more than 2 weeks including weekends and holidays in principle. There is no restriction on the timing of participation, but it is encouraged to avoid the term of classes. If the internship period and term of classes are overlapped, students need to consult with their advisors before starting the program.

**10. Note**

If you have any questions or concerns, please consult with the secretariat, your academic advisor, and the Dean of the Graduate School.

# Internship 2 (インターンシップⅡ)

Grade	All grades
Semester	1st or 2nd
Credits	1 or 2
Instructor	Advisors, Grad. School Education Affairs Committee

## 1. Course Outline

This course aims to learn the theory and practice of advanced information technology and multicultural collaborative design, and cultivate the ability to discover and solve problems and design new social systems.

For the purpose, students will stay at the laboratory of overseas universities, research institutes, or enterprises for a few weeks to half a year or more, and be engaged in the academic activities with faculty members, researchers, and/or students there.

Students will have experiences of different cultures, enhance technological and communication skills, and develop the international mind as a future global talent.

A student decides the institute to stay and an overseas supervisor (or person in charge) beforehand, submit "overseas internship plan."

If the overseas internship plan is approved by the FUN supervisor and graduate school curriculum committee, a student will conduct the internship.

Styles of activities for overseas internships include collaborative research, workshops, short-term intensive schools and the like.

During the stay, a student will report progress to the FUN supervisor.

After the end of internship, students write "overseas internship report"

including the results of collaborative research, the outcome of workshop to participate in, the contents of the classes students took, etc. and present the report at a debriefing session.

## 2. Keywords

Advanced information technology, multicultural collaborative design, international mind

## 3. Course Objectives

The course objectives are as follows:

- Can carry out interdisciplinary research with a broad perspective (evaluated based on plan and results)
- Can become conscious to meta-learning and achieve self-regulated learning (evaluated by progress report)
- Can acquire an open and positive attitude towards different fields and different cultures (evaluated based on the contents of the report and the performance at the debriefing session)

## 4. Course Schedule

1: Briefing session

2-14: Internship activity at an overseas institute

15: Debriefing session

## 5. Prior/Post Assignment

Prior Assignment: Students participate in the in-campus briefing session, are interviewed with a FUN supervisor, and learn the purpose of the subject to comprehend the significance of the subject. Students make overseas internship plans.

Post Assignment: Students reflect the achievements gained through internship and various other things they learned, and write overseas internship reports. Students make presentations at a debriefing session.

## 6. Assessment

Based on the content of the overseas internship plan (40%), the progress report during stay (20%), the content of the outcome or the evaluation by overseas supervisor (30%), and the report after the internship and a debriefing meeting (10%), the graduate school curriculum committee makes a decision.

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**7. Textbooks**

**8. Language of Instruction**

Depends on the plan.

**9. Requirements for registration**

Regarding the eligibility for the class, comprehensive judge is made by language proficiency, student's record, and ability to carry out research. Regarding language proficiency, the results of TOEIC or TOEFL iBT will be taken into account. The ability to carry out research is assessed by examining the overseas internship plan submitted. Regarding the number of credits, it is decided according to the course content.

**10. Note**

Watch the schedule guide of the briefing session in the university.

Students are encouraged to take "Academic Literacy in Context 2" and participate in the Language Acquisition Program (Connections Cafe).

For questions and consultation, please contact a FUN supervisor at any time.

# Overseas Course Program (海外履修科目)

Grade	All grades
Semester	1st or 2nd
Credits	1 or 2
Instructor	Advisors, Grad. School Education Affairs Committee

## 1. Course Outline

If you take a course related to your own research theme while studying abroad, you can replace the credits acquired at the study abroad destination as credits for this course. Refer to the Web board for details.

## 2. Keywords

## 3. Course Objectives

## 4. Course Schedule

## 5. Prior/Post Assignment

Prior : make a plan at study abroad destination

Post : submit transcripts and syllabus at study abroad destination

## 6. Assessment

The graduate school education affairs committee examines the contents of the credits acquired at an overseas university and translates them into the unit of this subject.

## 7. Textbooks

## 8. Language of Instruction

Depends on the plan.

## 9. Requirements for registration

Before starting to study abroad, students have to contact the office (the education affairs section). If a student would study abroad at a sister university, a student has to check "Regulations on studying abroad of FUN students and acceptance of international students to FUN.

## 10. Note

# Advanced ICT Design (ICT デザイン通論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Kei Ito

## 1. Course Outline

This lecture deals in trends in leading technology and practical engineering by the collaboration of subject teacher and several professionals inside/outside of FUN. In addition, basic knowledge learning by e-learning materials.

## 2. Keywords

Project Management, Requirements Analysis, System Design, System Architecture, System Modeling, System Management, Service Design

## 3. Course Objectives

- Understanding some parts of practical engineering and their problems.
- Understanding practical problems engineers experienced.

## 4. Course Schedule

Because this lecture is handled by the cooperation with professionals outside of FUN, the detail course schedule is shown at the beginning of the lecture.

Target topics of the lecture are shown below.

- project management
- requirements acquisition, requirements analysis
- design, development of several systems
- system modeling
- system management and maintenance
- service design

## 5. Prior/Post Assignment

Pre: reading pre-materials and e-learning

Post: reflection of lecture contents and answering post-lecture questionnaire

## 6. Assessment

Quizzes for every lecture and some reports (80%), e-learning (20%)

## 7. Textbooks

Deliver required materials for each lecture

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Advanced Topics of Information Network 1 (情報ネットワーク特論 I)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Hiroshi Inamura

## 1. Course Outline

To learn the basic technologies and design principles for computer networks, in particular the optical networks. The network protection issues will also be covered in the lecture.

## 2. Keywords

Computer Network, Network design, Mobile Network

## 3. Course Objectives

To learn the basic technologies and design principles for computer networks and optical networks.

## 4. Course Schedule

Lecture 1-3 Overview of computer network systems  
Lecture 4-6 Overview of next-gen Internet systems  
Lecture 7-9 Overview of next-gen wireless communication systems  
Lecture 10-12 Design of network architecture and protocols  
Lecture 13-15 Technologies in business on Web/Network services

## 5. Prior/Post Assignment

Reading course material in prior to the classes. Finishing assignments required.

## 6. Assessment

The course grades are basically determined by class participation and report.

## 7. Textbooks

The materials are specified in the course.

## 8. Language of Instruction

In Japanese. Course materials are provided in Japanese / English. Guest speakers may talk in Japanese and provide materials in Japanese.

## 9. Requirements for registration

None

## 10. Note

# Advanced Topics of Information Network 2 (情報ネットワーク特論Ⅱ)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Yoshitaka Nakamura

## 1. Course Outline

We introduce the basic technologies of various advanced networks such as IoT and distributed network with respect to information network (computer network / Internet) which is the basic technology of information system, and lecture on security technologies and sensing technologies.

This lecture is handled by a faculty member who has an experience as a visiting researcher in the company.

## 2. Keywords

computer network, information security, authentication

## 3. Course Objectives

Students will be able to understand basic technologies and security techniques for building information networks.

## 4. Course Schedule

1. Introduction
2. Outline of network system
3. Information Security
- 4-5. Distributed network technology and security
- 6-7. IoT & Sensing technology and security
- 8-9. Privacy protection technology
- 10-11. Authentication technology
- 12-13. Advanced technical commentary by advanced researchers
- 14-15. Task assignment presented by students

## 5. Prior/Post Assignment

Prior: Read handouts (about 20 pages).

Post: Do a task report issued in the lecture.

## 6. Assessment

Grades are comprehensively assessed based on each issue report and one oral presentation. The ratio will be informed in the class.

## 7. Textbooks

The materials are specified in the course.

## 8. Language of Instruction

Lecture materials in English and Japanese, and Oral Explanation in Japanese

## 9. Requirements for registration

None

## 10. Note



# Advanced Topics in Data Science (データ科学特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Naoyuki Sato,  
Ayahiko Niimi

## 1. Course Outline

This course consists of two parts.

In part A: The overview of the theory, modeling and design of database systems, to learn about the processing of large-scale data.

In part B: Statistical Machine Learning methods have been developing drastically in recent years and are utilized to extract information from massive data. In this course of lectures, we show the introduction as well as applications of such methods.

## 2. Keywords

Database, Data model, Massive data processing, Machine learning, Pattern recognition

## 3. Course Objectives

This course introduces data store, data analysis, and data processing for understanding of basic theory of information science.

The aim of the course is to learn the massive data processing technology.

## 4. Course Schedule

Part A:

1. Data model
2. Relational data model
3. SQL
4. Database design
5. Transaction processing
6. Database and programming
7. Massive data processing

Part B:

1. Maximum Likelihood Estimation(MLE) and Bayesian Inference
2. Model selection
3. Sampling methods and numerical methods
4. Statistical test
5. Classification method
6. Unsupervised learning
7. Non-parametric method
8. Ensemble method

## 5. Prior/Post Assignment

Prior: Work on assignments given in the class.

Post: Solve the quizzes.

## 6. Assessment

The final score is decided by final examination and/or reports. The ratio will be informed in the class.

Grades are separated Part A and Part B, and final grade is sum of them.

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## **7. Textbooks**

There are many topics in this lecture, the textbooks will be specified at the first lecture.

There will be selected references each week if necessary.

- reference book: An Introduction to Database Systems: Eighth Edition (C. J. Date) Addison-Wesley, 2003

- reference book: Pattern Recognition and Machine Learning (Christopher M. Bishop) Springer, 2010

## **8. Language of Instruction**

Lecture materials in English and Japanese, and Oral Explanation is in Japanese (or some part is in Japanese and English).

## **9. Requirements for registration**

This course is necessary the knowledge of the undergraduate level probability, statistics and database engineering.

## **10. Note**

# Advanced Topics in Information Environmentology (情報環境学特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Koji Tsukada,  
Yoh Shiraishi

## 1. Course Outline

Recently, computers and information technology became “ubiquitous” in the daily environment, such as smart phones and IoT (internet of things). This course focuses on such new information environment, and introduces fundamental technology and application through recent research projects.

## 2. Keywords

Ubiquitous Computing, Human Computer Interaction, Locating Technology, Activity Recognition

## 3. Course Objectives

Learning fundamental technology and application of recent information environment.

## 4. Course Schedule

The possible topics in this course are as follows:

- Ubiquitous Computing
- Human Computer Interaction
- Tangible Interface
- Augmented Reality
- Wearable Interface
- Personal Fabrication
- Advanced Sensing Technology
- Locating Technology
- Navigation
- Network and Database
- Intelligent Transport Systems
- Collective Intelligence and Open Data
- Smart City and Mobility

## 5. Prior/Post Assignment

Prior: Prepare the contents designated in each class.

Post: Do assignment given in class or HOPE.

## 6. Assessment

Presentation, Report, Attendance attitude. The ratio will be informed in the class.

## 7. Textbooks

None. Some books and papers might be introduced for references in the lecture.

## 8. Language of Instruction

Japanese only. Presentation and report are allowed both in Japanese and English.

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Media Information Studies (メディア情報学特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Ikuma Sato

## 1. Course Outline

Image processing is used in many industrial areas, including factory automation, publishing, broadcasting and other many business areas, and also in personal application such as entertainment, home security, mobile phones, etc. In this course, we learn fundamental principles of image processing and their applications to interactive systems. In the lecture, class students are requested to write image processing codes.

## 2. Keywords

Multimedia Information Processing, Image Processing, Computer Vision, Feature Extraction, Pattern Recognition

## 3. Course Objectives

In Advanced Topics in Media Information Studies, we will explore fundamental image processing methods to develop an interactive, intelligent systems.

## 4. Course Schedule

1. The difference of image processing and computer vision
- 2-3. Image formation and its mathematical models
- 4-5. Region-based image processing and image filtering
6. Geometric transformations
7. Binary image processing
8. Pattern detection using image features
- 9-10. Pattern recognition
- 11-12. Time-varying image processing
- 13-15. Programming practice

## 5. Prior/Post Assignment

Prior: Prepare the contents designated in each class.  
Post: Review the contents designated in each class.

## 6. Assessment

Small Exercises (50%)  
Final Assignments (50%)

## 7. Textbooks

Textbook: Digital Image Processing, Okutomi, CG Arts Society  
Reference: Computer Vision: Algorithms and Applications, Szeliski, Springer

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

It is desirable to have knowledge of undergraduate image engineering and C programming language.

## 10. Note

Next year, Prof. Terasawa will teach this course.  
The main theme will be image processing with emphasis on feature extraction and pattern recognition.

# Advanced Topics in Field Information Studies (フィールド情報学特論)

Grade	Master's 1st or 2nd grade
Semester	1st
Credits	2
Instructor	Yuichi Fujino, Masaaki Wada

## 1. Course Outline

This lecture covers some specific examples and methods to introduce the latest ICT and processes of business and R&D field in the primary industry, medical and welfare field. Topics of the first half lectures include some studies about visualization of spatial information using ICT in the primary industry. And we mention the acquisition and processing technology of big data. Topics of second half lectures start about the definition of Field Informatics. We introduce bio-logging, North and South Polar Region studies based in ICT, NTT Labs. R&D techniques, CATV industries and wearable computer developing fields

## 2. Keywords

Filed Informatics, Research and Development, Sensor Network, Bio-logging, Big Data, Ethnography

## 3. Course Objectives

There are some definitions of Field Informatics. We define it as an unapproachable and diverse social scene. This lecture introduces some specific examples and methods to describe, design and solve the social scene. They will learn some developments based on ICT from some engineers and researchers, directly. The goal of this lecture is to understand how ICT is used in various fields.

## 4. Course Schedule

1. Orientation, What is Field Informatics?
2. Field informatics of the primary industry
3. Sensor network system
4. Geographic information system
5. Application in agriculture
6. Application in fisheries
7. Bio-logging
8. Big data
9. Field informatics in the the Marine Products Industry
10. Field informatics in the Communication Field
11. Field informatics and Block Chain Techniques
12. Field informatics in the Wearable Computer Field
13. Field informatics in the North Polar Region
14. Field informatics in the South Polar Region
15. Field informatics in the CATV Industry

## 5. Prior/Post Assignment

Reporting about the contents of lectures

## 6. Assessment

Some reports or presentations in the first and second lectures are totally evaluated.

## 7. Textbooks

Introduction of Field Informatics, Kyoritsu Shuppan

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Advanced Topics of Embedded Systems (組込システム特論)

Grade	Master's 1st or 2nd grade
Semester	2nd
Credits	2
Instructor	Takeshi Nagasaki

## 1. Course Outline

This course has two components like the following to understand what kind of techniques are necessary to develop embedded systems and obtain these techniques.

- (1) Enterprises developers give lectures about the business world, for example, techniques for embedded systems or recent trends.
- (2) Lectures about basic techniques for embedded system by me. To be more specific, you will make an inverted pendulum robot by Lego Mindstorms NXT to develop an understanding about “task segmentation system on real-time control method,” “communication between tasks,” and “task scheduling” for practical training.

## 2. Keywords

Embedded system, Realtime system, Software Modeling

## 3. Course Objectives

You aim to obtain advanced techniques for embedded systems and related matters.

## 4. Course Schedule

- (1) Lectures by enterprises developers 7 lessons
    - A) Practicing modeling development 2 lessons
    - B) Product lifecycle 1 lesson
    - C) Introducing examples of each area; 3 lessons
      - Automobile related example
      - Industrial Equipment example
      - Consumer equipment example
  - (2) Practicing embedded systems by Lego Mindstorms NXT 8 lessons
    - A) Introducing real-time OS, which we will use in the course, and its sample programs. 1 lesson
    - B) Practicing real-time processing and its programming. 3 lessons
    - C) Development control program. 4 lessons
- Notes: Times of each lesson may be change at the developer's convenience.

## 5. Prior/Post Assignment

Prior: Read lecture materials.

Post: Work on assignments given in the class.

## 6. Assessment

The result will be evaluated by the report.

## 7. Textbooks

I will give instructions in the course, accordingly.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Advanced Open Technologies (オープン技術特論)

Grade	Master's 1st or 2nd grade
Semester	2nd
Credits	2
Instructor	Taku Okuno

## 1. Course Outline

Present enterprise information systems are constituted by heterogeneous system that consists of many computers, which are closely coupled within an organization and are loosely coupled through the Internet, i.e. the open systems. Information engineers working in the critical uppermost phase of system development processes need to grasp the business strategy and to realize it by utilizing the information systems together with various stakeholders.

This lecture introduces constituent technologies of open systems, real-world examples of enterprise businesses that utilize information technologies and systems, and the uppermost phase of system development process. Enterprise engineers practically teach their own specialties week by week.

## 2. Keywords

Open System, System Integration, Financial Information System, Business Model Building, Linked Open Data, Big Data, Innovation, Artificial Intelligence, Robotics, Interoperability

## 3. Course Objectives

Students will understand constituent technologies of open systems, real-world examples of enterprise businesses that utilize information systems, and the uppermost phase of system development process.

## 4. Course Schedule

The following is the results of 2018, content differs from year to year.

1. Introduction to open technologies
2. International interoperability and open technologies – date-time and characters
3. Birth story of No. 1 development cloud for mobile apps: Monaca, and Monaca education business
4. Social innovation to start from making experiences
5. Overview of banking system and financial solution
- 6-7. Business planning exercise using business model canvas
8. Open technologies to think from the development site at Yokohama
9. System development centered on non-functional requirements
10. Technology trends of robot voice dialogue
11. Relationship between statistics and big data
12. Service core technologies of name card management business: making data of name card (research, development and operations)
13. Introduction to Linked Data technology – how to make data that link
14. How to bring about innovation in the manner of Singularity University
15. Business case examples of IT industry

## 5. Prior/Post Assignment

Prior: Do pre-learning tasks assigned by lecturers.

Post: Do feedback to lecturers (questions and comments on the lecture).

## 6. Assessment

The total of reports counts 50%. All of the reports must be submitted until the end of classes.

The total of feedback and question reports (attendance) counts 50%. At least 2/3 of the reports must be submitted in principle.

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**7. Textbooks**

Reference book: will be introduced as needed.

**8. Language of Instruction**

Japanese

**9. Requirements for registration**

**10. Note**



# Advanced Topics in IT Architecture (IT アーキテクチャ特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Katsuya Matsubara

## 1. Course Outline

The work of the course is to read public documents and source code of Android, and to develop small application programs for understanding the excellent and notable architecture design corresponding to system requirements from smartphone, TV and in-vehicle system with one platform.

The teaching materials are made by an instructor who has experience in the field as a developer of system software such as Android for products.

## 2. Keywords

Software Architecture, System Design, Android

## 3. Course Objectives

- Understanding architecture design of large scale software
- Designing functionalities and API of a software system under considering performance, availability, extensibility, and operation cost.
- Implementing an Android according to design philosophy.

## 4. Course Schedule

This course will be divided in 9 chapters as follows:

1. Background, the latest development of Android
2. SDK and tools
3. System architecture
4. Application model
5. Framework for application collaboration
6. Inter-process communication
7. Bootstrap
8. Framework for graphics and media processing
9. Access control and security

## 5. Prior/Post Assignment

Prior: Review the content of the previous lecture.

Post: Work on homework (program or report) given in the class.

## 6. Assessment

Grades are comprehensively assessed based on assignment (program/oral presentation/ report) and participation attitude to the class. The ratio will be informed in the class.

## 7. Textbooks

Reference Book: Karim Yaghmour, "Embedded Android", O'Reilly

Reference Book: Tae Yeon Kim, Hyung Joo Song, Ji Hoon Park, Bak Lee, Ki Young Lim, "Inside Android", Personal Media (in Japanese)

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Service Management (サービス・マネジメント特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Michiko Oba

## 1. Course Outline

Service research service industry or manufacturing, began service as a business in industries such as information industry. And, it applications and how to catch and to the service of as any value-creating businesses that human conduct is evolving. In this lecture, new perceptions and applications of this service, to learn about the management in order to create and operate the service.

## 2. Keywords

Services, Service Science, Service management, start a business, entrepreneur

## 3. Course Objectives

This lecture is the theme of service management.  
What is service, how capture, what is produced so, and whether is managed and operated  
Learning the basic theory about the service management.  
Learning variety of application examples.

## 4. Course Schedule

- What is services!
- New perceptions of service
- Service-oriented project management
- Decision support and service value
- Service of to promote corporate sustainability
- Service value creation model
- Service transformation of information business by approach
- Collaboration as seen from the service point of view
- And information ideas creation method of service
- Service-oriented information element stems business of organization theory

## 5. Prior/Post Assignment

Previous learning: Prepare for the next lesson.  
Follow-up learning: Submit a report assignment.

## 6. Assessment

Reports(90%)and presentation(10%).

## 7. Textbooks

Textbook:  
小坂満隆編「サービス志向への変革-顧客価値創造を追求する情報ビジネスの展開-」(社会評論社)  
Other reference books are instructed as appropriate at the time of lecture. In case

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

None

## 10. Note

None

# Introduction to Information Design (情報デザイン通論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Yasushi Harada

## 1. Course Outline

Students read and solve the theory from the books or papers about the information design.

An illustration is used as the method. Author's point of argument and theory are illustrated and explained.

## 2. Keywords

information design, information graphics, user experience, interaction design, design thinking

## 3. Course Objectives

To clarify positioning of the information design which can be put on the present society by reading the history of the information design.

## 4. Course Schedule

01 orientation

02 lectures in turn 1

03 lectures in turn 2

04 lectures in turn 3

05 lectures in turn 4

06 lectures in turn 5

07 lectures in turn 6

08 lectures in turn 7

09 lectures in turn 8

10 lectures in turn 9

11 lectures in turn 10

12 lectures in turn 11

13 lectures in turn 12

14 creating and sharing each portfolio

15 reflection

The subject book is chosen from candidates within a lecture.

## 5. Prior/Post Assignment

Pre-learning: Read task books and summarize them in materials.

Post-learning: brush up the materials to complete as a report.

## 6. Assessment

reports, attendance

## 7. Textbooks

assignment books are selected together with the students in the first lesson.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

Textbooks will be decided according to the research theme of the students for the first lesson.

## 10. Note

This class is to be held in the first half of the latter term.

# Introduction to Cognitive System (認知システム通論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Noyuri Mima

## 1. Course Outline

This class will focus on the uniqueness of the research methods and research contents regarding the intersection of cognitive science and information science. It will be dealt with specific themes related to the user interface research as particular application fields such as learning environment design and artificial intelligence research based on knowledge and learning. Cognitive science is an interdisciplinary area related to engineering, linguistics, and psychology. Students are expected to understand the research stream related to learning and user-interface such as situated cognition and legitimate peripheral participation theory. At the same time, cultivate the attitude of participation of graduate seminar, such as how to read technical books, how to understand, how to present, and discuss the specific application of research results.

## 2. Keywords

knowledge, learning, learning environment design, artificial intelligence, user interface, situated cognition

## 3. Course Objectives

Understand the fundamental knowledge and new direction on cognitive science research contents and research methods.

Developing skills of reading, understanding, presenting and discussing on specialized books in a postgraduate lecture (seminar).

## 4. Course Schedule

1-2week

Noyuri Mima "Designing Future Learning: Space, Activity, and Community" (University of Tokyo Press). Both books are written in Japanese.

3-7week

Jean Lave and Etienne Wenger "Situated Learning: Legitimate Peripheral Participation" (Cambridge University Press).

8-14 week

Lucy Suchman "Plans and Situated Actions: The Problem of Human-machine Communication" (Cambridge University Press).

15 wrap up

## 5. Prior/Post Assignment

As preliminary learning, you are required to read the relevant documents every time and summarize the contents to PowerPoint. Also, you need to think about the parts related to your research and reference parts in the textbook and summarize it in PowerPoint.

In the post learning, you need to reflect the understanding in the class in the PowerPoint which is summarized in advance.

## 6. Assessment

Evaluate by participation in discussion in class (70%), and term paper (report) (30%).

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## **7. Textbooks**

Noyuri Mima "Designing Future Learning: Space, Activity, and Community" (University of Tokyo Press). Both books are written in Japanese.

Jean Lave and Etienne Wenger "Situated Learning: Legitimate Peripheral Participation" (Cambridge University Press).

Lucy Suchman "Plans and Situated Actions: The Problem of Human-machine Communication" (Cambridge University Press).

## **8. Language of Instruction**

The lecture is basically done in Japanese, but for students who need English, I prepare English texts and oral explanations with Japanese and English.

## **9. Requirements for registration**

## **10. Note**

# Introduction to Interactive Systems (インタラクティブシステム通論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Shigeya Yasui

## 1. Course Outline

By making works, this course provides an introduction to learning of

- effects of interactive systems
- human computer interaction on interactive systems
- how to design systems using these knowledge.

Practice:

- Prototyping of user interface as "shape which symbolizes an action"
- Final presentations using prototype

## 2. Keywords

Interface design, Human computer interaction, Image psychology

## 3. Course Objectives

This course provides an introduction to learning of

- effects of interactive systems
- human computer interaction on interactive systems
- how to design systems using these knowledge.

## 4. Course Schedule

1. Orientation
- 2-3 Analysis for existence interactive system
- 4-5 Identify issues
- 6-7 Concept making
- 8 Presebtation
- 9-13 prototyping
- 14 Rehearsal
- 15 Setting up exhibition

## 5. Prior/Post Assignment

## 6. Assessment

Excises, report, and presentation.

## 7. Textbooks

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Fundamentals of Media Design (メディアデザイン基礎)

Grade	Master's 1st or 2nd grade
Semester	1st
Credits	2
Instructor	Kenichi Kimura, Misako Nambu

## 1. Course Outline

Kimura:

Editorial work is a great and fundamental knowledge technology which allows us to exchange our knowledge extensively and to produce new values and systems from our interrelationship. It also is a prevailing technology encouraging societal change. Today's media environments are shaped by editorial work as the art of organizing knowledge.

This course deals with booklet as an example of media and attempts to organize and enhance knowledge by the process of designing media.

Nambu:

Analysis human-media interaction from a perspective of human.

Consider the relationship between human cognition and media design based on quantitative and qualitative analyses of respective subject.

This course is designed by two instructors, Kimura is an experienced editorial designer and Nambu has an experience in qualitative field research.

## 2. Keywords

media design, editorial design, graphic design, DTP, organizing knowledge, qualitative research and analysis

## 3. Course Objectives

The goal of this course is to understand the background, present situation, and future tasks of media design field, by learning the process of planning and editing media, and by mastering basic research and analysis methods.

## 4. Course Schedule

1-4. Overview: background, present situation, and future tasks of media design field.

5-6. Methods: making abstract of materials; interview and description; fieldnotes and information card.

7-15. DTP and Editing: information structure of booklet and plates; typeface and layout; graphic design; editorial design.

## 5. Prior/Post Assignment

Prior: Work on assignments given in the class.

Post: Improve the product based on the review and discussion in the class.

## 6. Assessment

Grading will be decided based on class attendance and the quality of submitted products.

## 7. Textbooks

Background materials will be announced in the class.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

This course requires skills of operating DTP applications; InDesign, Illustrator, Photoshop, and so on.

## 10. Note

# Special Topics of Information Design 1 (情報デザイン特論 I)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Hidekatsu Yanagi

## 1. Course Outline

The emergence of new media (computer, smartphone, SNS) due to the development of technology has enabled more advanced communication. In this course, we will focus on the historical transition of expression technology by various media and clarify the structure of information transmission. And we will examine methods applicable to expression of contemporary arts & design. Then, we will redefine the functions and structures in the object of arts & design as the concept of information and consider the essence of objects invariant among different types of media. After these works, students will create an experimental model of information expression to provide “a comfortable dialogue” and “new experience” for people and society, and students will learn new expression technology in information transmission.

## 2. Keywords

Media design, Media art, Media technology, Information expression

## 3. Course Objectives

In this course, we will consider the meaning and structure of the information in the real society. And we will reconstruct the information in a new form to realize dialogue between people and people or people and things. Students will learn the knowledge and skills necessary to design “a comfortable dialogue” in the real society.

## 4. Course Schedule

1. Orientation
2. Outline of art
3. Outline of design
4. Introduction to media
5. Introduction to Expression and Media
6. Introduction to Media Art
7. Introduction to Historical transformation of expression technology
8. Analysis of media
9. Analysis of media
10. Presentation about Media
11. Proposal of new Media (Experimental Model for Information Expression)
12. Proposal of new Media (Experimental Model for Information Expression)
13. Prototype production
14. Prototype production
15. Presentation, Exhibition

## 5. Prior/Post Assignment

- Appreciation of design museums and art museums.  
Reference website:  
<http://www.2121designsight.jp/>  
<https://www.3331.jp/>
- Plan and present an exhibition about the Achievements of the lecture.

## 6. Assessment

Evaluated by class participation, reports, presentations, exercises, and final exhibition

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**7. Textbooks**

Edward R. Tufte, (1990) 『Envisioning Information』 (ISBN 0-9613921-1-8)

**8. Language of Instruction**

Lecture: Japanese

Lecture materials: Japanese, English

**9. Requirements for registration**

Messages to students: Let's communicate closely and make lively discussions.

**10. Note**

It is basically a lecture focusing on personal work.

Outside the class, in addition to preparation, production work may occur.

# Special Topics of Information Design 2 (情報デザイン特論Ⅱ)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Nam-Gyu Kang

## 1. Course Outline

In this class, the student can understand a concept and practice of information design to enhance Kansei value. The students will create new design based on the understanding of previous researches and practices about Kansei engineering.

## 2. Keywords

Kansei design, Kansei value, Information design

## 3. Course Objectives

Understand the new methodology of information design through lectures / reading / simple exercises.

## 4. Course Schedule

1-4. Understand about Kansei design based on previous researches and practices  
5-6. Create a Kansei value in information design  
8-14 Understand about Kansei design based on a practice  
15. Presentation

## 5. Prior/Post Assignment

Please, read the book named 'Emotional Design' before start this class. And search about 'What is Emotional(Kansei) Design?' also.

## 6. Assessment

The unit credentials should be evaluated based on the attitude in the class and the results of proposal.

Attitude in the class (30 %)

Results of proposal (70 %)

## 7. Textbooks

Emotional Design

## 8. Language of Instruction

Main language is Japanese. (English is OK!)

## 9. Requirements for registration

None

## 10. Note

# Special Topics of Cognitive System 1 (認知システム特論 I)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Mitsuhiko Hanada

## 1. Course Outline

Knowledge of human cognitive information processing is necessary for good design. Basic knowledge about visual information processing is also useful for computer graphics and image processing. In the first half of this lecture, perceptual information processing such as color perception is explicated. In addition, how knowledge about perceptual information processing is applied to information technology is introduced. In the second half of this lecture, psychological research methods and statistical analysis for psychological data are explained. Participants in this lecture learn data analysis such as multivariate analysis by analyzing actual psychological data with statistical software.

## 2. Keywords

cognitive system, perceptual information processing, psychological research methods, multivariate analysis

## 3. Course Objectives

Students in this lecture learn human cognitive information processing. They also learn psychology research methods such as experimental design to study human information processing.

## 4. Course Schedule

1. Introduction
- 3-4. Color representation system
- 5-6. Color vision
7. Visual information processing
8. Color management
9. Experimental design
- 10-12. Principal component analysis and factor analysis
- 13-14. Other statistical methods
15. Summary

## 5. Prior/Post Assignment

Prior: Prepare the contents designated in each class  
Post: Do assignment given in each class

## 6. Assessment

Assignments (reports) in each class

## 7. Textbooks

None.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

None.

## 10. Note

None.

# Special Topics of Cognitive System 2 (認知システム特論Ⅱ)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Kiyohide Ito

## 1. Course Outline

The seminar is aimed at getting the overview of what is soundscape through reading literatures and by use of practicing in the field (Hakodate city).

In this seminar, we are going to read some books or papers about soundscape. We practice the techniques for recording soundscape by use of PCM recorders.

## 2. Keywords

Ecological psychology, Acoustics, Sound design

## 3. Course Objectives

The goals are as follows : (a) Obtaining basic knowledge of soundscape, (b) Learning how to represent soundscape.

## 4. Course Schedule

## 5. Prior/Post Assignment

Pre lecture task: (a) To summarize each resume of literatures, (b) To complete recording task until the deadline.

Post lecture task: (a) To find out articles and read through them which you are interested in, (b) To consider the relationship between your study theme and this seminar.

## 6. Assessment

1. Attendance (20%).
2. Final achievement of making soundscape (80%).

## 7. Textbooks

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Special Topics of Interactive Systems 1 (インタラクティブシステム特論 I)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Kazushi Mukaiyama

## 1. Course Outline

Interactive systems are various because they need total perspective of academic researches. Therefore, it's difficult to understand it in general situation. Then, in this class each student sets their own purpose him/herself, and check latest researches and activities of interactive system. Finally, every students share their report and understand the cutting-edge of interactive system history. This is designed by a professor who has the professional experience in Art and Design

## 2. Keywords

Interaction, Interactive System

## 3. Course Objectives

- \* Survey: read academic published papers.
- \* Discussion: report one paper and discussing about it with others.
- \* Practices: understand some system pragmatically in some case.

## 4. Course Schedule

1. Orientation
- 2-5. Lecture: Recent trends in interactive systems
- 6-9. Lecture: History of interactive system
- 10-11. Survey: Trends and understanding of interactive systems
- 12-13. Exercise: Practice to make a model of the system
14. Oral Presentation
15. Final discussion and report submission

## 5. Prior/Post Assignment

- Before: To prepare the contents instructed in each time.  
After: To do homework instructed in each time.

## 6. Assessment

evaluated by an oral presentation and a report

## 7. Textbooks

depending on online articles on every classes

## 8. Language of Instruction

Japanese, English

## 9. Requirements for registration

You must attend the first time to know the important information in this class.

## 10. Note

To get cutting-edge research topic, it is flexible to establish events for the benefit of students.

# Special Topics of Interactive Systems 2 (インタラクティブシステム特論Ⅱ)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Yoshiaki Mima

## 1. Course Outline

HTML5 is a collection of technical elements, which is specified to support building programs on WEB browsers. It is possible to get many useful information related to HTML5, such as CSS and/or JavaScript by trolling on the Internet, however, it is difficult to construct systematic understanding. In this lecture, we focus on the technical topics systematically, such as HTTP, JavaScript, CSS, DOM, CANVAS, SVG, and also have practices on coding. We also have simple practices on CGI and database.

## 2. Keywords

HTML5, Client-side Programming, JavaScript, CSS, DOM, Systematic Knowledge Construction

## 3. Course Objectives

Through building small codes based on HTML5 technology, we construct a conceptual map on a shared notebook. Our goal is to re-construct the knowledge of HTML5 to be more systematic and make us easy to design WEB services.

## 4. Course Schedule

1. HTTP Protocol
- 2-3. CGI Theory and Implementation, Database
4. HTML Elements and CSS
- 5-6. JavaScript Basic, ASYNC communication
7. JavaScript Advanced (OO features)
- 8-9. DOM, DOM Events Theory and Implementation
10. Elements and Drag-and-Drop
- 11-13. CANVAS Theory and Implementation
14. SVG
15. Presentation

## 5. Prior/Post Assignment

Preparation: 2 members are assigned as a presenter of a specific technology. Each has to make a presentation for 10 minutes.

Homework: Participants share one document on the Internet and make a note. Each article should have signature to specify its owner.

## 6. Assessment

Evaluated by the quality of presentation and the description on the note.

## 7. Textbooks

(not specified)

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

As we write codes, experiences on command line interface and text editing capability is required.

## 10. Note

# Advanced Topics in Information Mathematics (情報数理特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Keiji Suzuki

## 1. Course Outline

Multiagent systems are introduced as the tools for distributed problem solving and decision support.

In this lecture, especially, it is focused that Distributed Constraint Satisfaction, Distributed Optimization, Bayesian games and Congestion games.

## 2. Keywords

Multi-agent Systems, Distributed Constraint Satisfaction, Distributed Optimization, Non-cooperative game theory

## 3. Course Objectives

Goal of this lecture is to understand the modeling of multiagent systems.

## 4. Course Schedule

Introduction to Multi-agent Systems(1)

Distributed Constraint Satisfaction(3)

Distributed Optimization(3)

Introduction to Non-cooperative game theory(3)

Bayesian games and Congestion games(3)

Introduction to Coalitional Game theory(2)

## 5. Prior/Post Assignment

Prior: Prepare the contents designated in each class.

Post: Do assignment given in each times.

## 6. Assessment

Students will be evaluated on several reporting assignments.

## 7. Textbooks

The course will be mainly conducted by writing on whiteboard, and specified no reference.

Papers will be introduced in the course.

## 8. Language of Instruction

Lecture materials in English, Oral Explanation in Japanese and English

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Nonlinear Mathematics (非線形数理特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Yuichi Katori

## 1. Course Outline

The aspect concerning the "movement" of the world including nature, artificial, and social systems can be regarded as a nonlinear dynamical system and can be described as mathematical models. Many of these systems have nonlinearity and thus rich dynamical properties. In this lecture, we learn methods to analyze such nonlinear systems. In particular, we focus on the dynamics of the nerve cell (neuron) and neural network.

## 2. Keywords

Nonlinear dynamics, Neural network

## 3. Course Objectives

- Understanding the characteristics of nonlinear dynamical systems and the fundamentals of analysis of the nonlinear dynamical systems.
- Analyzing the stability and bifurcation phenomena on a basic nonlinear dynamical system.
- Understanding the relationship between the neural network dynamics and its information processing.

## 4. Course Schedule

1. Introduction
- 2-4. Analysis of nonlinear dynamical system
- 5-6. Hodgkin-Huxley equation and neural membrane dynamics
- 7-8. Dynamics of a single neuron
- 9-11. Dynamics of neural network
- 12-14. Information processing on the neural networks
15. Summary

## 5. Prior/Post Assignment

Read and understand distributed materials. Solve some questions on the distributed materials.

## 6. Assessment

assignment (paper), participation attitude to the class.

## 7. Textbooks

1. Steven H. Strogatz. Nonlinear Dynamics and Chaos with Applications to Physics, Biology, Chemistry, and Engineering. Westview Press.
2. Yuri A. Kuznetsov. Elements of Applied Bifurcation Theory. Springer.
3. Eugene M. Izhikevich. Dynamical Systems in Neuroscience. The MIT Press.

## 8. Language of Instruction

Lecture materials in English and Japanese, and oral explanation in Japanese and English

## 9. Requirements for registration

## 10. Note



# Advanced Topics in System Mathematics (システム数理特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Nobuyuki Takahashi

## 1. Course Outline

A state space representation is a mathematical model of a dynamical system as a set of input, output and state variables related by differential equations. This lecture goal is that the students will be able to get informations from the output data in the system, to predict and control the system using the state space representation.

## 2. Keywords

data analysis, time series analysis, state space representation, dynamical system, linear and nonlinear systems, modeling, prediction, control

## 3. Course Objectives

This lecture introduces the basic knowledge of Complex Systems Information Science such as 'modeling', 'prediction', and 'control'.

## 4. Course Schedule

1. Introduction: State space representation
2. Gaussian and linear state space models
3. AR models
4. State estimation
5. State smoothing
6. Statistical modeling and Markov models
7. Kalman filter
8. Gaussian and linear state space model examples
9. Non-Gaussian and nonlinear state space models
10. Gaussian mixed models
11. Extended Kalman filter
12. Approximated distribution function
13. Application examples
14. Non-Gaussian model examples
15. Non-Gaussian and nonlinear state space model examples

## 5. Prior/Post Assignment

Summarize the lecture oral explanation in your notebook.

## 6. Assessment

Some reports(60%) and the final exam(40%).

## 7. Textbooks

Reference book:

- 1) Time Series Analysis by State Space Methods, J.Durbin and S. J. Koopman, Oxford University Press,2001.
- 2) Pattern Recognition And Machine Learning (Information Science and Statistics, Christopher M. Bishop, Springer-Verlag, New Ed,2006.

## 8. Language of Instruction

Lecture materials in English and Japanese, and Oral Explanation in Japanese.

## 9. Requirements for registration

Knowledge of probability theory, analytics, linear algebra is required.

## 10. Note

# Advanced Topics in Mathematical Analysis (数理解析特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Hiroaki Sasaki

## 1. Course Outline

Machine learning is recently gathering a great deal of attention and becoming an indispensable technology in information science. In this lecture, students learn basics of machine learning and some important methods for data analysis. In the first part of this lecture, we first review basics of probability and statistics, and then important concepts in machine learning are learned through least-squares regression. In the last part of this lecture, after learning some linear methods in classification, we focus on basic topics of neural networks.

## 2. Keywords

Machine learning, regression, classification, neural network

## 3. Course Objectives

- Understanding basic concepts in machine learning
- Understanding linear methods in regression and classification
- Understanding basics of neural networks

## 4. Course Schedule

- 1-2. Introduction and review of probability and statistics
  - Expectation, probability density function, Bayes' theorem, maximum likelihood estimation
- 3-6. Least-squares regression
  - Regression, overfitting, generalization error, regularization, bias-variance decomposition, model selection, Bayesian approach
7. Midterm test
- 8-10. Classification
  - Criteria for classification, linear discriminant analysis, logistic regression
- 11-14. Neural network
  - Multilayer perceptron, backpropagation, stochastic gradient, convolutional neural network, autoencoder
15. Final test

## 5. Prior/Post Assignment

- (Prior) Read the handouts  
(Post) Review what you learned in the lectures

## 6. Assessment

Assessment is based on the midterm test (30%), final test (40%) and pop quizzes in the lectures (30%)

## 7. Textbooks

- Reference: Pattern recognition and machine learning, C.M. Bishop, Springer, 2006
- Reference: Deep learning (in Japanese), Takayuki Okatani, Kodansha, 2015
- Other references will be notified in the lecture

## 8. Language of Instruction

Japanese / English

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Applied Complex Systems (応用複雑系特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Toshiji Kawagoe

## 1. Course Outline

Designing a desirable voting rule that aggregates individual preferences is a main topic of Social Choice Theory. But there exists no desirable voting rule except for dictatorship. This negative result is a famous Arrow's impossibility theorem. If an individual can successfully manipulate the voting outcome, such a voting rule is not strategy-proof. But, in general environment, there exists no strategy-proof voting rule except for dictatorship. This is called Gibbard-Satterthwaite theorem. Those topics are taught in first part of this lecture. In the second part of the lecture, topics in Market Design are introduced. Main focus is on auction theory and matching theory.

## 2. Keywords

Social choice theory, Voting, Market design, Auction, Matching

## 3. Course Objectives

Understanding the basics of Social Choice Theory and Market Design

## 4. Course Schedule

1. What is Social Choice Theory?
2. Apportionment problem
3. Paradox of voting
4. Arrow's impossibility theorem
5. Strategy-proofness
6. Gibbard-Satterthwaite theorem
7. Liberal paradox
8. King Solomon's dilemma
9. Basics of auction theory
10. Revenue equivalence theorem
11. Auctions with multiple goods
12. Stable marriage problem
13. College admission problem
14. School choice problem
15. Matching with contracts

## 5. Prior/Post Assignment

Prior: Read a part of textbooks and articles assigned

Post: Summarize the important points addressed in the class in your notebook.

## 6. Assessment

By mid-term and end-term reports (70%) and evaluation for classroom discussion (30%)

## 7. Textbooks

- Roth, A. E. and M. A. O. Sotomayor (1990) Two-Sided Matching: A Study in Game-Theoretic Modeling and Analysis, Cambridge University Press
- Krishna, V. (2009) Auction Theory, Second Edition, Academic Press.
- Feldman, A. E. and R. Serrano (2005) Welfare Economics and Social Choice Theory, Springer Verlag.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Complex Systems (複雑系システム特論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Shigeru Sakurazawa

## 1. Course Outline

Through constructing the complex system in which many elements interact each other and new characteristic of the whole system emerge, we will think about new information processing. From such a view point, the course focuses on the concrete examples of characteristics of biological systems, biological phenomena, non-equilibrium thermodynamics, self-organization and autonomy. Students need no special background knowledge. Everybody can take this course.

## 2. Keywords

complex systems, biological systems, non-equilibrium thermodynamics, self-organization, autonomy

## 3. Course Objectives

The course introduces special topics about information representation, constructive approach (construction of complex systems) and computing paradigm as key words for complex system science.

## 4. Course Schedule

1. General theory
  - Information expression about phenomena
  - Constructive approach
  - Computation Paradigm
2. Biological systems and information
  - emergent systems
  - autonomy of systems
  - Physics of spontaneity - basics of thermodynamics
  - Concept of non-equilibrium thermodynamics and entropy
  - Self-organization
  - Motor proteins
  - Origins of life
3. Internal measurement
  - Internal measurement and autonomy
  - Theory of sense
  - Perception and action in ecological psychology
  - Physical movement and biological movement
  - Selection and juggling action

## 5. Prior/Post Assignment

Reserch for related topics

## 6. Assessment

Students are evaluated by only final report. There will be no exam.

## 7. Textbooks

None

## 8. Language of Instruction

Japanese. English explanation will be added if necessary.

## 9. Requirements for registration

## 10. Note

# An Introduction to Intelligent Information Science (知能情報科学通論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Asuka Terai,  
Hajime Murai

## 1. Course Outline

This lecture presents the fundamental concepts of the recent artificial intelligence research. You can learn how the recent AI ideas such as partiality of information, embodiment, real-time algorithms so on become more important than physical symbol system hypothesis. And we study how the important concepts are implemented in the real world systems by some examples.

In this lecture, the instructors are researchers in artificial intelligence field, and the instructors explain about actual utilization and application in research and development based on their experiences.

## 2. Keywords

Artificial intelligence, behavior-based intelligence, frame problem, symbol grounding problem

## 3. Course Objectives

The object is to study the philosophy of artificial intelligence, and to become possible to understand and explain papers about artificial intelligence.

## 4. Course Schedule

The lecture is designed to learn basic concepts underlying intelligence information science.

Aiming to touch on latest researches, presentation and discussions will be held after reading papers. The contents of the lecture are the following:

- 1 Introduction for AI
- 2 History of AI researches
- 3 Change of thinking about AI
- 4 Knowledge representation
- 5 Problem solving and game
- 6 Natural language
- 7 Intelligence based on embodiment
- 8 Creativity
- 9 Development of future artificial intelligence
- 10-15 Presentation and discussions about research paper

## 5. Prior/Post Assignment

Before: To search related research papers and to understand these papers

After: To do an assignment on "manaba"

## 6. Assessment

The exercises (presentation and report) 80% and the learning attitude 20%.

## 7. Textbooks

References are introduced in the lecture.

## 8. Language of Instruction

Japanese, handouts are both English and Japanese

## 9. Requirements for registration

## 10. Note

# History and Future of Intelligent Systems (知能システムの歴史と未来)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Ian Frank

## 1. Course Outline

The scope of the course is potentially vast, including for example Ancient Greek theories on the philosophy of mind, philosophical debates about the nature of the universe (eg, the watchmaker argument), intelligent systems in literature, the history of psychometric testing and of multiple intelligences and IQ, as well as predictions about the future of artificial intelligence (the possibility of a 'singularity'). Each year, we try to find and work on the questions and subjects in which the students have an interest.

## 2. Keywords

stories, algorithms, philosophy, awareness

## 3. Course Objectives

Students will be expected to:

- gain a perspective on historical development of ideas
- gain knowledge of important figures in past and present
- improve the granularity of their understanding of the current speed of technological progress
- participate in a forward-thinking class project

## 4. Course Schedule

The plan depends on the students that enrol. In general, I expect that this will not be a traditional 'lectured' course. Students will be challenged to think for themselves, and to use and develop their own critical faculties (itself a meta-theme on intelligence). The first class will be activity based, so please come prepared to take part.

Richard Saul Wurman calls teaching a "binary choice": teach about what you already know or teach about what you would like to learn. I prefer, as him, the latter. So, this class will try to have the lecturer run his "mind parallel to the mind of a student, rather than acting as a director of traffic". I realise that this is a high goal, but I don't think that all classes at FUN should be teacher-led.

## 5. Prior/Post Assignment

Prepare by reading about research in intelligent systems, and becoming attuned to future trends. Follow-up by reading about research in intelligent systems, and becoming attuned to future trends.

## 6. Assessment

Attendance and student reports/projects. There will be no exam, since one question we may examine will be 'Can intelligence be measured by a test?' One possible goal of the class will be to produce something that can be published or demonstrated outside FUN.

## 7. Textbooks

There are no particular course textbooks. There may be reading assignments modified to meet the interests of the students.

## 8. Language of Instruction

Japanese

## 9. Requirements for registration

## 10. Note

# An Introduction to Intelligent Systems Programming (知能システムプログラミング通論)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Koji Kato

## 1. Course Outline

In the research, it is important to verifying the methods as well as theoretical learning. Therefore, in this lecture, students program several kinds of basic machine learning methods and verify the differences of those methods.

## 2. Keywords

Programming, Machine learning, Presentation

## 3. Course Objectives

This lecture introduces the programming methods using machine learning.

## 4. Course Schedule

This course make use of following methods.

1. Neural network
2. Genetic programming
3. Support vector machine

Finally an applied problem using these methods.

## 5. Prior/Post Assignment

## 6. Assessment

Attendances and Reports.

## 7. Textbooks

None

## 8. Language of Instruction

Basically use Japanese language. Some documents may use English.

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Adaptive Systems (適応システム特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Sadayoshi Mikami,  
Seiji Takagi

## 1. Course Outline

To make a robot or an autonomous software/hardware agent, it is essential to have a functionality that responds properly to its environment. Such an adaptive mechanism inherently involves in an ability to learn and optimize from experiences. This lecture introduces some basic methods of learning and optimizing by experiences, such as Reinforcement learning and Bio-Inspired Computing methods. As a sideway, this lecture also touches with some topics relating to standard machine learning algorithms, including Naive Bayes, Learning from Examples, and Support Vector Machines.

## 2. Keywords

Machine Learning, Data Mining, Robot, Agent, Reinforcement Learning, Naive Bayes, SVM, Statistical Learning Algorithms, Ant Colony Optimisation, Bio Inspired Computation, Particle swarm optimization

## 3. Course Objectives

This lecture aims at understanding the basics of adaptive systems. By this lecture, students will be able to choose appropriate adaptive methods to a given problem. The methods includes some traditional classification machine learning algorithms, Bio-Inspired Computing, and Reinforcement Learning methods.

## 4. Course Schedule

1: A short guidance

Part-I

- 2: System dynamics and differential equations
- 3: Environmental adaptation system of microorganisms
- 4: Synchronization, entrainment and movement of swarm
- 5: BOID, Particle Swarm Optimization (PSO)
- 6: Amoeboid algorithm for network optimization
- 7: Ant Colony Optimization (AOC)

Part-II

- 8-9: Reinforcement Learning
- 10-12: Basic machine learning methods
- 13: Learning from examples, linear classifiers
- 14-15: Support Vector Machine and Kernel methods

## 5. Prior/Post Assignment

Prior: Read the handout of the next lecture posted on the HOPE.  
Posterior: Read the handout of the lecture to develop an understanding.

## 6. Assessment

Final report (Part-I, 50%, Part-II, 50%).

## 7. Textbooks

(Part-I, reference) Data Mining: Practical Machine Learning Tools and Techniques, Ian H. Witten, et al., Morgan Kaufmann, 2011.  
(Part-II, reference) Biologically Inspired Optimization Methods, Mattias Wahde, WIT Press, 2009.

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**8. Language of Instruction**

Lecture materials in English and Japanese, and Oral Explanation in Japanese

**9. Requirements for registration**

Bring your PC that is accessible to HOPE system. It will be better if the PC can run Java and Python programs.

**10. Note**

# Advanced Topics in Autonomous System 1 (自律システム特論 I)

Grade Master's 1st or 2nd grade  
Semester 1st  
Credits 2  
Instructor Ei-Ichi Osawa

## 1. Course Outline

This lecture covers various theories of agent and multiagent systems. Agent is an intelligent and autonomous entity, and multiagent systems consists of multiple agents. These theories include practical reasoning, interaction among agents, design methodology, and applications.

## 2. Keywords

Agent, multiagent, practical reasoning, communication, reactive agent, collaboration.

## 3. Course Objectives

Several well known agent and multiagent theories and systems are introduced. Also, we discuss design of agent systems and application of agent systems.

## 4. Course Schedule

1. Introduction
2. Intelligent agents
3. Agent oriented programming
4. Practical reasoning agents
5. Rective and hybrid agents
6. Multiagent interaction
7. Reaching agreements
8. Communication
9. Collaboration
10. Methodology
11. Applications

## 5. Prior/Post Assignment

## 6. Assessment

Assessment will be done based on three reports and one programming assignment.

## 7. Textbooks

Michael Wooldridge, "An Introduction to MultiAgent Systems", Wiley.

## 8. Language of Instruction

Japanese and English

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Autonomous System 2 (自律システム特論Ⅱ)

Grade	Master's 1st or 2nd grade
Semester	2nd
Credits	2
Instructor	Sho'ji Suzuki, Yasuyuki Sumi

## 1. Course Outline

For realizing autonomous intelligent systems, it is indispensable to understand and utilize the theory and method to select appropriate behaviors according to self/environmental situation. This course focuses on location estimation (localization) by robot and human activity estimation. Topics include robot navigation, Kalman filter, activity recognition by accelerometer data, situation estimation of human social interactions, and so on.

## 2. Keywords

robot, localization, Kalman filter, multimodal data, situation understanding

## 3. Course Objectives

The aim of this course is to provide the fundamental knowledge for realizing autonomous and intelligent systems.

## 4. Course Schedule

1. Introduction
- 2-8. Localization of the robot
  - Navigation Technology
  - Localization by Sensing
  - Kalman Filter
- 9-15. Human behavior understanding
  - Estimation of Human Behavior by Multimodal Sensed Data
  - Estimation of Social Interaction of Human
  - Conversational Analysis by Nonverbal Behaviors

## 5. Prior/Post Assignment

Prior: Prepare the contents designated in each class.

Post: Review after the class.

## 6. Assessment

We evaluate based on homework reports and in-class practice.

## 7. Textbooks

## 8. Language of Instruction

Lecture materials in English and Japanese, Oral Explanation in Japanese and English

## 9. Requirements for registration

## 10. Note

# Advanced Topics in Intelligent Media (知能メディア特論)

Grade Master's 1st or 2nd grade  
Semester 2nd  
Credits 2  
Instructor Keiji Hirata

## 1. Course Outline

The main topics of music informatics include the investigation of cognitive mechanisms, the construction of computational models, and the realization of application systems in terms of listening, composition, and performance as humans do. To explore music informatics, students need to widely understand computer science, artificial intelligence, and musicology. In the lecture, I would treat the important topics to learn music informatics which are usually not deeply treated in other related lectures.

The lecture consists of three parts. In the first part, I would take the topics related to scientific philosophy such as semiotics and theory of model as the fundamental knowledge for learning music informatics. In the second part, I would introduce cognitive music theories as the preparation of computational approach. In the third part, I would give assignments to students regarding automatic composition by deep learning and discuss machine creativity with students.

The lectures has been planned and carried out by the person who had an experience in field.

## 2. Keywords

Music informatics, music generation by deep neural networks, cognitive music theory

## 3. Course Objectives

Students will learn the theory and knowledge of musical structures and semantics, and the scientific findings about human cognition in music.

Students will learn programming of music generation by deep neural networks

Students will learn the media processing techniques that applicable to the media other than music, such as paralanguage, body motion, and video, and further, acquire the perspectives of the meta-view point by overlooking media processing .

## 4. Course Schedule

### Part I

1. Semiotics
2. Theory of Model
3. Musical Semantics
4. Gestalt Occurring in Music
5. Music and History of Philosophy of Science

### Part II

6. Preliminary of Musical Knowledge
7. Generative Theory of Tonal Music (Grouping and Metrical Analyses)
8. Generative Theory of Tonal Music (Time-Span and Prolongational Reduction)
9. Tonal Pitch Space
10. Implication-Realization Model

### Part III

11. Machine Learning in Music Information Processing (Deep Neural Networks, Bayesian Inference)
12. Survey of Papers on Music Creation by AI
13. Music Generation by Deep Neural Networks: Preliminaries, Introduction to Tools
14. Music Generation by Deep Neural Networks: Exercise 1
15. Music Generation by Deep Neural Networks: Exercise 2

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**5. Prior/Post Assignment**

Prior: Preview the slides that would be opened beforehand, and go through homework documents

Post: Study the terms and concepts etc. that could not be understood during a class and solve unclear points. Solve exercises (programming).

**6. Assessment**

The behavior of attending classes, the submissions and results of assignments (programming) are taken into account comprehensively. The ratio of each item for calculating the final score is announced in the class.

**7. Textbooks**

Tojo and Hirata, Music, Mathematics, and Language - Opening a New Horizon for Music by Information Science-, Kindaikagakusha (2017). In Japanese.

**8. Language of Instruction**

Lecture materials in English and Japanese, and oral explanation in Japanese

**9. Requirements for registration**

**10. Note**

Students have to bring their own PC that enables them to connect the intra-network at every class because students use the HOPE web site.

# Project Study 1 (課題研究 I)

Grade	Master's 1st grade
Semester	1st
Credits	2
Instructor	Advisors

## 1. Course Outline

Students mainly work on practical research promotion process, acquire research methodology and research techniques, and study basic theory and skills required to achieve the research for the master's thesis.

In Project Study 1, it aims at acquiring basic theory and skills. First, students set the contents to study and goal for half year, and set appropriate studying materials and topics. Students present the studied contents from time to time in the classes, write comprehensive report in the end of the semester, and give presentation.

## 2. Keywords

Information Architecture, Media Design, Complex Science, Intelligence Science, literature Survey, Case Study

## 3. Course Objectives

The aims of the course are that students experience practical research promotion process and acquire research methodology, research techniques, basic theory and skills.

## 4. Course Schedule

Study and research plan are made after consulting with advisors.

## 5. Prior/Post Assignment

Prior Assignment: We'll conduct literature surveys of relevant fields.

Post Assignment: We'll set up research tasks.

## 6. Assessment

Grades are based on performance, presentation, and report.

## 7. Textbooks

References are decided after consulting with advisors.

## 8. Language of Instruction

The language of the instruction depends on the professor.

## 9. Requirements for registration

## 10. Note

## Project Study 2 (課題研究Ⅱ)

Grade	Master's 1st grade
Semester	2nd
Credits	2
Instructor	Advisors

### 1. Course Outline

In Project Study 2, students develop the contents achieved in the Project Study 1, set study theme which is closer to the research theme for master's thesis, investigate related research fields, investigate research promotion process with conducting case-study. Students write the report about the studied contents in the end of the semester, and give presentation

### 2. Keywords

Information Architecture, Media Design, Complex Science, Intelligence Science, literature Survey, Case Study

### 3. Course Objectives

The aims of the course are that students experience practical research promotion process and acquire research methodology, research techniques, basic theory and skills.

### 4. Course Schedule

Study and research plan are made after consulting with advisors.

### 5. Prior/Post Assignment

Prior Assignment: We'll also conduct case studies as well as literature surveys on relevant fields.

Post Assignment: We'll plan the research promotion procedure.

### 6. Assessment

Grades are based on performance, presentation, and report.

### 7. Textbooks

References are decided after consulting with advisors.

### 8. Language of Instruction

The language of the instruction depends on the professor.

### 9. Requirements for registration

### 10. Note

## Project Study 3 (課題研究Ⅲ)

Grade	Master's 2nd grade
Semester	1st
Credits	2
Instructor	Advisors

### 1. Course Outline

In Project Study 3, students investigate, develop, construct the research themes continuing from Project Study 2, write the report about the research themes and give presentation about the research result.

### 2. Keywords

Information Architecture, Media Design, Complex Science, Intelligence Science, literature Survey, Case Study

### 3. Course Objectives

The aims of the course are that students experience practical research promotion process and acquire research methodology, research techniques, basic theory and skills.

### 4. Course Schedule

Study and research plan are made after consulting with advisors.

### 5. Prior/Post Assignment

Prior Assignment: We'll prepare for the report and presentation on research contents.

Post Assignment: We'll consideration the results of the research.

### 6. Assessment

Grades are based on performance, presentation, and report.

### 7. Textbooks

References are decided after consulting with advisors.

### 8. Language of Instruction

The language of the instruction depends on the professor.

### 9. Requirements for registration

### 10. Note



# System Information Science Research (システム情報科学研究)

Grade	Master's 1st through 2nd grade
Semester	All
Credits	4
Instructor	Advisors

## 1. Course Outline

Students set their own research themes from the wide-ranging areas of Systems Information Science, conduct research under the direction of advisors, write master's thesis, and give presentation. They acquire skills to extract problems to study, make research process, describe the research results with sentences, and give presentation through the research experience.

## 2. Keywords

science of complex systems, information science, science of design, and cognitive science

## 3. Course Objectives

The course improves the capability as engineers and researchers through the research.

## 4. Course Schedule

Research plan are made after consulting with advisors.

Submission of research plan, participation in interim presentation session, and submission of master's thesis are required.

## 5. Prior/Post Assignment

## 6. Assessment

Grades are based on screening master's thesis or specific theme according to the school rules.

## 7. Textbooks

## 8. Language of Instruction

The language that a supervisor ordered.

## 9. Requirements for registration

## 10. Note

# Special Seminar (特別ゼミナール)

Grade	DC1,2,3
Semester	All
Credits	-
Instructor	Supervisors

## 1. Course Outline

This subject aims at developing specialised knowledge and research methodology to pursue the student's research in Systems Information Science. It will be achieved by investigating related areas, learning the methodologies of related areas, observing real-world problems, and self-development by resolving these problems.

## 2. Keywords

Systems Information Science, Creation of New Results, Doctoral Thesis

## 3. Course Objectives

- Students will be able to systematically understand the field of Systems Information Science, contribute to the development of academia and industries, and develop specialized knowledge and research methodology that contain open-minded advanced academic achievements for creating new results.
- Students will be able to pursue new principles and new methods. They will be able to write a doctoral thesis through the research processes including research theme setting, research plan making, research evaluation, presentations in academic conferences, and paper writings.

## 4. Course Schedule

Discussion with the supervisor. The frequency and time will vary by the instructions given by the supervisor.

## 5. Prior/Post Assignment

Prior: Prepare reports of research progress, research survey, and experimental results. The students will discuss with the supervisors by using the materials.  
Posterior: Pursure the students' own research by the feedback given by the supervisors.

## 6. Assessment

-

## 7. Textbooks

Indicated by the supervisors.

## 8. Language of Instruction

The communication language will be indicated by the supervisor.

## 9. Requirements for registration

## 10. Note

At the end of every semester, a midterm presentation will be requested. It is intended to show the progress of the doctoral research to the audiences in the university.

# System Information Science Special Research (システム情報科学特別研究)

Grade	DC1,2,3
Semester	All
Credits	-
Instructor	Supervisors

## 1. Course Outline

Students will write their doctoral thesis through research process such as research theme setting, research plan, research evaluation, research presentation at academic conferences, preparation of research papers etc., with the aim of pursuing new principles and new methods under the research guidance of academic supervisors.

In addition, they cultivate their abilities as advanced engineers and researchers.

## 2. Keywords

It depends on students.

## 3. Course Objectives

Students will proactively conduct their research and prepare their doctoral thesis, thereby acquiring independent research capabilities under the guidance of academic supervisors.

## 4. Course Schedule

Planning a research plan after consulting with their academic supervisor.

## 5. Prior/Post Assignment

Study according to their own research plan.

## 6. Assessment

Grades are assessed based on midterm presentations, the pre-thesis examination by presentation, the thesis examination, and the certificate examination of degree.

## 7. Textbooks

None

## 8. Language of Instruction

The language that a supervisor ordered.

## 9. Requirements for registration

None

## 10. Note

None

Appendix: Dividend Year, Credits and Instruction Language of Class

Category	Subject Names	Dividend Years	Credits		Instruction Language	Notes	
			R	E			
Outline of Subjects	Master's Program Specialized Subjects	Academic Literacy in Context I	1	(2)		J	Students must earn 30 or more credits (20 or more credits for specialized subjects and 10 or more credits for research guidance subjects) and pass the thesis review and examination.  Students may be allowed to complete the program, after their research outcome is reviewed and considered it appropriate to the purpose of their master's study.  Students must earn 2 or more credits of parenthesized subjects, "Academic Literacy in Context I" and "Academic Literacy in Context II".  The credits of "Internship II" and "Overseas Course Program" marked '※' are 1 or 2.
		Academic Literacy in Context II	1	(2)		E	
		Introduction to Basics of Systems Information Science	1・2		2	-	
		Internship Program I	1・2		2	-	
		Experimental Design and Data Analysis	1・2		2	J&E	
		Internship Program II	1・2		※	-	
		Overseas Course Program	1・2		※	-	
		Advanced ICT Design	1・2		2	J	
		Advanced Topics of Information Network I	1・2		2	J&E	
		Advanced Topics of Information Network II	1・2		2	J&E	
		Advanced Topics in Data Science	1・2		2	J&E	
		Advanced Topics in Information Environmentology	1・2		2	J&E	
		Advanced Topics in Media Information Studies	1・2		2	J	
		Advanced Topics in Field Information Studies	1・2		2	J	
		Advanced Topics of Embed Systems	1・2		2	J	
		Advanced Open Technologies	1・2		2	J	
		Advanced Topics in IT Architecture	1・2		2	J	
		Advanced Topics in Service Management	1・2		2	J	
		Introduction to Information Design	1・2		2	J	
		Introduction to Cognitive System	1・2		2	J&E	
		Introduction to Interactive Systems	1・2		2	J	
		Fundamentals of Media Design	1・2		2	J	
		Special Topics of Information Design I	1・2		2	J&E	
		Special Topics of Information Design II	1・2		2	J&E	
		Special Topics of Cognitive System I	1・2		2	J	
		Special Topics of Cognitive System II	1・2		2	J	
		Special Topics of Interactive Systems I	1・2		2	J&E	
		Special Topics of Interactive Systems II	1・2		2	J	
		Advanced Topics in Information Mathematics	1・2		2	J&E	
		Advanced Topics in Nonlinear Mathematics	1・2		2	J&E	
		Advanced Topics in System Mathematics	1・2		2	J&E	
	Advanced Topics in Mathematical Analysis	1・2		2	J&E		
	Advanced Topics in Applied Complex Systems	1・2		2	J&E		
	Advanced Topics in Complex Systems	1・2		2	J&E		
	An introduction to intelligent information science	1・2		2	J&E		
	History and Future of Intelligent Systems	1・2		2	J		
	An Introduction to Intelligent Systems Programming	1・2		2	J&E		
	Advanced Topics in Adoptive System	1・2		2	J&E		
	Advanced Topics in Autonomous System I	1・2		2	J&E		
	Advanced Topics in Autonomous System II	1・2		2	J&E		
	Advanced Topics in Intelligent Media	1・2		2	J&E		
	Research Guidance Subjects	Project Study I	1	2		-	
		Project Study II	1	2		-	
Project Study III		2	2		-		
System Information Science Research		1~2	4		-		
Doctor's Program	Specialized Subjects	Internship Program II	1・2・3		※	-	Students must pass the thesis review and examination.  The credits of "Internship II" and "Overseas Course Program" marked '※' are 1 or 2.
		Overseas Course Program	1・2・3		※	-	
	Research Guidance Subjects	Special Seminar	1~3			-	
Research on Systems Information Science		1~3			-		

J : Japanese  
E : English