



Saga University

*Interdisciplinary education program for AI and data science
specialists (IEPAD)*

Subject Guide

2025 Enrollment Students

Master Course

**Science and Engineering
Advanced Health Science**

Doctor Course

Science and Engineering

Contents

ACADEMIC CALENDER	1
--------------------------------	---

Class hours	1
--------------------------	---

Description of the Master Course and

Guidance of course registration	2
--	---

Course Registration and Requirements for the Degree	2
---	---

Special Subjects	7
------------------------	---

Core Subjects	7
---------------------	---

Outline of Core Subjects	9
--------------------------------	---

Curriculum for the students of Data Science Course	14
--	----

Outline of Major Subjects	15
---------------------------------	----

Curriculum for the students of Computer Science and Information Technology Course	18
---	----

Outline of Major Subjects	19
---------------------------------	----

Curriculum for the students of Advanced Materials Chemistry Course	21
--	----

Outline of Major Subjects	22
---------------------------------	----

Curriculum for the students of Energy and Mechanical Engineering Course	24
---	----

Outline of Major Subjects	25
---------------------------------	----

Curriculum for the students of Mechanical Systems Engineering Course	27
--	----

Outline of Major Subjects	28
---------------------------------	----

Curriculum for the students of Electrical and Electronic Engineering	30
--	----

Outline of Major Subjects	31
---------------------------------	----

Curriculum for the students of Civil Engineering Course	33
---	----

Outline of Major Subjects	34
---------------------------------	----

Curriculum for the students of Architectural Design Course	36
--	----

Outline of Major Subjects	37
---------------------------------	----

Curriculum for the students of Biomedical Engineering Course	39
--	----

Outline of Major Subjects	40
---------------------------------	----

Curriculum for the students of Functional Biomolecular Science Course	42
---	----

Outline of Major Subjects	43
---------------------------------	----

Description of the Doctor Course and

Guidance of course registration	45
--	----

Course registration and requirements for the degree

[Outline of Subjects]

Course of Mathematical and Information Science	52
--	----

Course of Mechanical and Electrical Energy Engineering	52
--	----

Course of Civil Engineering and Architectural Design	52
--	----

Course of Biological and Material Engineering	52
---	----

Saga University Campus Map

ACADEMIC CALENDAR

AUTUMN SEMESTER

October 1, 2025	Autumn Semester begins.
October 1, 2025	Classes start.
October 3, 2025	Entrance Ceremony (for Autumn Enrollment Students)
December 25, 2025	Winter Vacation (until January 7)
February 6, 2026	Autumn Semester Examination (until February 13)
March 31, 2026	End of the Autumn Semester

Class hours

Period	I	II	III	IV	V
Time	8:50~10:20	10:30~12:00	13:00~14:30	14:40~16:10	16:20~17:50

Master Course

Description of the Master Course and Guidance of course registration Course registration and requirements for the degree

(1) Philosophy of foundation

This special educational program has been established to nurture talented engineers and researchers who are able to contribute to the development of Asian countries and the construction of an international network for advanced scientific and technological development in the fields of AI and Data science through master's course education. They are expected to play globally and actively as well. The curriculum consists of Data Science Course, Computer Science and Information Technology Course, Advanced Materials Chemistry Course, Energy and Mechanical Engineering Course, Mechanical Systems Engineering Course, Electrical and Electronic Engineering Course, Civil Engineering Course, Architectural Design Course, Biomedical Engineering Course, and Functional Biomolecular Science Course. Students are involved in one of these courses. This program provides a comprehensive education for the students to gain extensive knowledge necessary to create innovation on AI and Data science under the collaboration among Japanese and foreign students. Opportunities to develop international communication skills are also provided. All lectures are given in English and the thesis should be written in English. Completed students will be active globally in AI and Data science fields as engineers for the development, management, research and so on.

The Graduate school of Science and Engineering and Graduate School of Advanced Health Sciences of Saga University will make every effort necessary to achieve the goal.

(2) Research supervisor

The school selects one main advisory professor/associate professor and one vice-advisory professor/associate professor for each student with reference to student's requests. Researching guidance will be given concerning subject matter such as graduate research and compilation of graduate thesis.

Students will receive this guidance and start their graduate research from their first year of master course. Also, the students will receive a course registration guidance by the main advisory professor.

(3) Requirements for the degree.

Requirements for completion of the master course.

- The period of course study should be equal to or more than two years.
- The number of credits earned should be equal to or more than 60 credits.
- To pass final examinations and faculty evaluation of master thesis.
- In certain cases, those students who show superior results may be able to finish the master course in one year.
- Those students who meet the above necessary requirements will be conferred any one of Master of Science and Master of Engineering.

(4) Subjects and credits

Master course students are required to complete a minimum of 60 credits.

	Special Subjects	Core Subjects	Major Subjects	TOTAL
Minimum of credit	6	12	42	60

- Special subjects consist of Collaborating PBL (2 credits), Synthetic Seminar (2 credits) and Intensive International seminar for Interning Study (2 credits) and all are compulsory.
 - ① Collaborating PBL (compulsory): Students deal with problems or projects concerning AI and Data science fields as task under collaborating with Japanese and foreign students. Appropriate adviser will guide them considering the issue.
 - ② Synthetic Seminar (compulsory): The purpose of this subject is to check the progress of research work and to give some advices for putting it forward. His/her course will organize the seminar accordingly.
 - ③ Intensive International Seminar for Interning Study (compulsory): In principle, each student must participate in an international partnership held in Saga University or in a country other than the student's nationality. Instead of an international partnership, each student may participate in an intensive seminar or a summer school which is performed in English in a country other than the student's nationality.

- ④ Practical Cooperative Project (elective): The purpose of this project is to participate in project research conducted by faculty members of the Graduate School of Science and Engineering, to deepen exchanges with researchers and engineers outside the university, and to nurture knowledge as a professional. For example, students may participate in joint research and projects with companies, research institutes, and CIREn (Co-creative Innovation platform for Renewable Energy) related to the student's specialty. Credits of this subject can be included in the number of credits of Major Subjects. Students need to talk with your main advisory professor in advance.
 - ⑤ Regional Collaborative Career Workshop (elective/optional): The aim of the workshop is to assist international students to form the cultural and societal basis for their activities in job hunting in Japan and to some extent working for Japanese companies, including their future internships in Japanese companies. The workshop is provided in collaboration with companies in Saga prefecture and the Saga prefectural government. The workshop is held as a year-round subject, starting in the autumn semester. The credits (two) of the workshop are not counted to satisfy any partial requirement to obtain an academic degree in IEPAD.
 - ⑥ Regional Collaborative Internship (elective/optional): This internship course aims to assist international students who seriously want to work in Japan in the future to understand the working environment and working in Japanese companies or organizations through practical work experience that utilizes general skills including their characteristics of being international students. This work-based internship is provided in collaboration with companies in Saga prefecture and the Saga prefectural government. This internship course is a year-round course in which a one-week internship is held during the summer break after prior orientation and guidance. To take this course, you should be a student who has taken or is currently taking the "Regional Collaborative Career Workshop, which requires students to have proficiency of Japanese for communication with people in companies, for example." The credit (one) of this internship course is not counted to satisfy any partial requirement to obtain an academic degree in IEPAD.
- Each student should earn at least 4 credits on Core subjects of Data Science Course or Computer Science and Information Technology Course. In addition, each student who belongs to Graduate School of Advanced Health Science should earn at least 4 credits on Core subjects of the Department that he/she belongs to.
 - Credits of Core Subjects exceeding 12 credits can be transferred to the Major subjects.
 - More than 42 credits from Major Subjects, including Advanced studies I ~ IV of courses.
 - By instruction of your supervisor, 6 or less credits of subjects of the other courses or other graduate schools in Saga University can be regarded as the Major Subjects. In this case, students are required to apply for it at Registrar Section for the Graduate School in Student Center at starting of the classes. However, for Core subjects, it is not necessary to follow the procedure.
 - Japanese students should earn credit on Advanced English for Academic Study in major subjects.

(5) Registration of classes

Students are required to submit registration notices to Registrar Section for the Graduate School in Student Center at starting of the new semester. Registration notices are available at Registrar Section for the Graduate School in Student Center. Students are also required to register the lectures through the internet "Live Campus". Students earn credits by attending classes, passing examinations and/or submitting reports.

理工学研究科及び先進健康科学研究科博士前期・修士課程 AI・データサイエンス高度人材の領域横断的育成プログラムにおける履修方法及び修了要件について

(1) プログラムの概要・目的について

本教育プログラムは、アジア諸国の発展と先端的科学技術開発の国際的ネットワーク構築に貢献できるグローバル人材の育成を目指して開設した大学院博士前期・修士課程のプログラムである。カリキュラムはデータサイエンスコース、知能情報工学コース、機能材料化学コース、機械エネルギー工学コース、機械システム工学コース、電気電子工学コース、都市基盤工学コース、建築環境デザインコース、生体医工学コース、健康機能分子科学コースで構成されている。学生はいずれかのコースに所属する。このプログラムでは、持続可能で豊かな社会へとシフトしてゆくために必要な AI やデータサイエンスに関する科学技術のイノベーション創出のための知識を日本人学生と外国人留学生が共に学び研鑽する。国外での英語によるコミュニケーション能力を養成する機会も設けられている。講義はすべて英語で行われ、修士論文も英語での執筆となる。修了者は AI やデータサイエンス分野の国際的企業で開発、管理、研究等に係る中核技術者として活躍することが期待される。

理工学研究科及び先進健康科学研究科は、このグローバルに活躍できる人材の育成のために最善の努力をする。

(2) 指導教員について

学生ごとに主指導教員及び副指導教員各 1 名を選出する。研究指導は、当該コースにおける研究分野に関するテーマ等を選定して行い、学生は 1 年次から研究指導を受ける。また、履修指導を主指導教員から受ける。

(3) 修了要件について

- ・当該課程に 2 年以上在学しなければならない。ただし、優れた業績をあげた者については、当該課程に 1 年以上在学すれば足りるものとする。
- ・ 60 単位以上を修得しなければならない。
- ・ 必要な研究指導を受けた上、当該課程の目的に応じ、修士論文又は特定の課題についての研究の成果の審査及び最終試験に合格しなければならない。
- ・ 学位の種類は、修士（理学）、修士（工学）となっている。

(4) 授業科目及び単位について

博士前期・修士課程の学生は、下記により 60 単位以上を修得しなければならない。

	プログラム 共通科目	コア科目	専門科目	合計
必要単位数	6	12	42	60

- ・ プログラム共通科目は、共学 PBL（2 単位）、総合セミナー（2 単位）、国際インターン研修（2 単位）を必修とする。

- ①共学 PBL（必修）は、日本人学生と外国人留学生が小グループを形成して共同して課題（Problem）あるいはテーマ（Project）に取り組む。課題あるいはテーマに応じて適切なアドバイザー教員が付き指導する。
- ②総合セミナー（必修）は、修士研究の進捗状況を発表する機会であり、所属するコースが計画・実施する。説明と使用する資料はすべて英語で行うこととなる。
- ③国際インターン研修（必修）は、本学が学生の国籍以外の国で開催する国際パートナーシップへの参加を原則とするが、学生の国籍以外の国で英語で行われる短期集中セミナー、サマースクールも認める。
- ④実践的協働プロジェクト（選択）は、理工学研究科の教員が実施しているプロジェクト研究に参加し、学外の研究者や技術者との交流を深め、専門的職業人としての素養を養う。学生の専門に関連のある企業、研究所や CIREn (Co-creative Innovation platform for Renewable Energy＝「再生可能エネルギー等イノベーション共創プラットフォーム」) 等との共同研究やプロジェクト等に参加してもよい。本科目の単位は、修了要件単位数のうちの専門科目の単位数に含めることができる。
- ⑤地域連携キャリア研修（選択）は、将来の就職活動、インターンシップを含めた日本での就労に資する留学生の文化的、社会的基盤の形成を支援することを目的とする。佐賀県及び県内の企業と協働して実施される研修である。研修は秋学期に開始し、通年科目として実施される。IEPAD の修了要件には含まれない。
- ⑥地域連携インターンシップ（選択）は、将来、日本での就労を真剣に望む留学生に、留学生である特性も活かす実践的な汎用的能力活用型の業務体験によって日本の企業や組織における労働環境や就労の理解を支援することを目的とする。佐賀県および県内の企業と協働して実施される業務遂行型インターンシップである。事前のオリエンテーションならびにガイダンスを実施後に、夏期休業期間中にインターンシップ（8 時間×5 日間）が実施される通年科目である。本履修においては、「地域連携キャリア研修」（日本語能力でのコミュニケーション力が必須）を履修した学生もしくは履修中の学生であることが必要である。IEPAD の修了要件には含まれない。
- ・コア科目については、データサイエンスコース又は知能情報工学コースから 4 単位以上を修得しなければならない。加えて、先進健康科学研究科の学生は、所属するコースから 4 単位以上を修得しなければならない。また、12 単位を超えて修得した単位は修了要件単位数のうちの専門科目の単位数に含めることができる。
 - ・専門科目は、各コースの特別研究Ⅰ～Ⅳを含め、42 単位以上を修得しなければならない。
 - ・主指導教員が研究指導上必要と認めた場合は、他コース又は他研究科の科目を履修することができる。修得した単位は、6 単位まで修了要件単位数のうちの専門科目の単位数に含めることができる。
- 他コース又は他研究科の科目を履修する場合は、申請書を各学期の履修手続期間内に教務課理工学研究科教務担当又は先進健康科学研究科教務担当に提出しなければならない。ただし、コア科目については、この手続きは不要とする。
- ・日本人学生は、学術英語特論を必修とし、修了要件単位数のうちの専門科目の単位数に含める

ものとする。

(5) 履修手続きについて

授業科目を履修し、単位を取得するためには、次の手続きを経なければならない。

履修登録は、履修手続期間内に **WEB** により行うこと。手続きの日程等については掲示により確認すること。

講義に出席し、定期試験を受験し、あるいは、レポート等を提出して合格点に達すれば、所定の単位が与えられる。

Special Subjects
(プログラム共通科目)

Course	Subjects		Teachers	Credits	Semester				
					25- I	25- II	26- I	26- II	27- I
All Courses	★Collaborating PBL(Compulsory)	共学PBL	TBD	2		○			
	★Synthetic Seminar(Compulsory)	総合セミナー		2	Intensive				
	★Intensive International Seminar for Interning Study(Compulsory)	国際インターン研修		2	Intensive				
	Practical Cooperative Project	実践的協働プロジェクト		2					
	Regional Collaborative Career Workshop	地域連携キャリア研修	H. Koga	2		○		○	
	Regional Collaborative Internship	地域連携インターンシップ	H. Koga	1			○		○

Core Subjects
(専門選択必修科目)

Course	Subjects		Teachers	Credits	Semester				
					25- I	25- II	26- I	26- II	27- I
Data Science Course	(A) Advanced Mathematical Structure for Information Science	情報数理構造特論	M. Hiroto	2				○	
	(A) Mathematical Analysis and Computation	数理解析特論	T. Kimura	2		○		○	
	(A) Computational Science	計算科学特論	Y. Hieida	2		○		○	
	Mathematical Data Science	データサイエンス数理特論	T. Minamoto	2			○		○
Computer Science and Information Technology Course	(B) Advanced Study of Artificial Intelligence	人工知能特論	Y. Okazaki	2			○		○
	(B) Learning Algorithms	学習アルゴリズム特論	N. Yamaguchi	2		○		○	
	(B) Information Visualization	情報可視化特論	O. Fukuda	2		○		○	
	(B) IT and Innovation	ITイノベーション特論	T. Kakeshita	2			○		
	(B) Advanced Computer Network	情報ネットワーク特論	E. Hanada	2				○	
	(B) Object Oriented Programming	オブジェクト指向プログラミング特論	W.L. Yeoh	2			○		
Advanced Materials Chemistry Course	Advanced Earth Environmental Chemistry	地球環境化学特論	H. Kodama	2		○		○	
	Colloid and Interface Engineering	界面化学工学特論	S. Morisada	2			○		○
	Advanced Ceramic Chemistry	セラミックス化学特論	M. Yada	2		○		○	
	Advanced Separation Technology	分離工学特論	K. Ohto	2			○		○
	Physico-Chemical Properties of Materials	材料物性化学特論	T. Narita	2					○
	Advanced Functional Electrode	電極機能材料化学特論	M. Tominaga	2			○		○
Energy and Mechanical Engineering Course	Advanced Thermal Energy Engineering	熱エネルギー工学特論	A. Miyara	2		○		○	
	Advanced Heat Engine Technology	エネルギー機関特論	Y. Mitsutake	2			○		○
	Advanced Fluid Mechanics for Energy	流体エネルギー力学特論	Y. Kinoue	2			○		○
Mechanical Systems Engineering Course	Advanced Robotics	ロボット工学特論	K. Sato	2		○		○	
	Advanced Surface Engineering	表面工学特論	H. Hasegawa	2			○		○
	Advanced Computational Mechanics	計算力学特論	Y. Tadano	2		○		○	
Electrical and Electronic Engineering Course	Advanced Wireless Communication Systems	ワイヤレス通信システム特論	I. Toyoda	2			○		○
	Advanced Adaptive Systems Theory	適応システム特論	H. Itoh	2		○		○	
	Advanced Hardware Interface Engineering	ハードウェア・インターフェース工学特論	H. Fukumoto	2		○		○	

Course	Subjects		Teachers	Credits	Semester				
					25- I	25- II	26- I	26- II	27- I
Civil Engineering Course	Water Environmental System Engineering	水環境システム工学特論	V. Narumol	2			○		○
	Advanced Wastewater Treatment Engineering	水処理工学特論	Y. Mishima	2		○		○	
	Advanced Geotechnical Engineering	地盤工学特論	T. Negami	2		○		○	
	Advanced Topics on Urban Environment	都市環境性能特論	H. Li	2			○		○
Architectural Design Course	Advanced Environmental Engineering of Architecture	建築環境工学特論	S. Kojima	2					○
Biomedical Engineering Course	Numerical Analysis in Biomedical Engineering	医工数値解析特論	K. Muramatsu	2			○		○
	Bioinformatics Programming	バイオインフォマティクス特論	H. Douzono	2			○		
	Neuro-Biological Information Processing	脳生体情報工学特論	T. Sugi	2		○		○	
Functional Biomolecular Science Course	Advanced Biocoordination Chemistry I	生命錯体化学特論I	M. Koikawa	1		○		○	
	Advanced Biocoordination Chemistry II	生命錯体化学特論 II	M. Koikawa	1		○		○	
	Advanced Chemical Spectroscopy I	分光化学特論I	M. Unno	1		○		○	
	Advanced Chemical Spectroscopy II	分光化学特論 II	M. Unno	1		○		○	
	Advanced Bioanalytical Chemistry I	生命分析化学特論I	T. Takamuku	1			○		
	Advanced Bioanalytical Chemistry II	生命分析化学特論 II	T. Takamuku	1			○		

Outline of Core Subjects

Data Science Course

< Advanced Mathematical Structure for Information Science > (情報数理構造特論)

Assoc. Prof. M. Hiroto

This lecture introduces cryptograph and algebra. The main topics are mathematical structure and algebraic principle applied in cryptograph.

< Mathematical Analysis and Computation > (数理解析特論)

Assoc. Prof. T. Kimura

In this lecture, we will discuss about 1) some methods for numerical Analysis, 2) mathematical backgrounds of numerical computation, 3) mathematical and numerical validation of computational error.

< Computational Science > (計算科学特論)

Assoc. Prof. Y. Hieda

Birth-death processes are used as models for natural and social phenomena. This series of lectures covers how to simulate a birth-death process from the basics including necessary mathematical background. This series assumes the ability to write Python programs, prior knowledge of probability (such as understanding the variance of the binomial distribution), and a level of mathematical proficiency equivalent to that of a graduate from the Faculty of Science and Engineering.

< Mathematical Data Science > (データサイエンス数理特論)

Prof. T. Minamoto

This lecture introduces mathematical concepts concerning data and computer science and provides a basis for further study in data science. Topics covered are mathematical modeling, statistics, machine learning, etc. The lecture describes connections between each of these mathematical concepts and modern data science applications.

Computer Science and Information Technology Course

< Advanced Study of Artificial Intelligence > (人工知能特論)

Prof. Y. Okazaki

From the perspective of problem solving, which is one of the important themes of artificial intelligence, we take up important points in artificial intelligence research, give lectures on each theme, and conduct exercises based on the contents.

< Learning Algorithms > (学習アルゴリズム特論)

Assoc. Prof. N. Yamaguchi

In this lecture, we will learn several learning algorithms for AI. Especially, we will learn 1) introduction to AI, 2) clustering, 3) pattern recognition, 4) reinforcement learning, and 5) search.

< Information Visualization > (情報可視化特論)

Prof. O. Fukuda

This subject explains various information visualization techniques and information visualization tools through lectures and exercises for accurate and efficient information understanding and information transmission.

< IT and Innovation > (IT イノベーション特論)

Assoc. Prof. T. Kakeshita

Information technology is necessary for building a future society such as Society 5.0 and DX (Digital Transformation). This lecture aims to expand students' perspectives through lectures on methodologies for creating various services using IT. Students will learn methodologies for creating various services using IT; service management techniques for continuously providing created services; competitive strategies for protecting the created services and establishing superiority over competitors.

< Advanced Computer Network > (情報ネットワーク特論)

Prof. E. Hanada

Today, we live in an "information network society," and information systems are the technological infrastructure. The intentions of this lecture are as follows;

- 1) To foster an understanding of the various digital communication technologies used in information systems
- 2) To foster an attitude of self-motivated pursuit of specialized knowledge that should be known in managing information networks.

< Object Oriented Programming > (オブジェクト指向プログラミング特論)

Assoc. Prof. W.L. Yeoh

Object-oriented programming is a programming scheme where data and their operations are combined as objects. The OOP enables us to make programming have seamless connections to target models. Moreover the OOP contributes effective programming processes through abstract programming and reusability of components. This lecture explains the scheme of the OOP with realistic examples.

Advanced Materials Chemistry Course

< Advanced Earth Environmental Chemistry > (地球環境化学特論)

Assoc. Prof. H. Kodama

Lectures about evaluation of electrostatic effect and binding constants distribution on the metal ion-binding equilibria in charged polyion systems.

< Colloid and Interface Engineering > (界面化学工学特論)

Assoc. Prof. S. Morisada

This class includes lectures on the basics of colloid and interface science, which are related to various chemical processes.

< Advanced Ceramic Chemistry > (セラミックス化学特論)

Prof. M. Yada

In this class, fundamentals including structures or syntheses of ceramics and their applications will be presented.

< Advanced Separation Technology > (分離工学特論)

Prof. K. Ohto

Lecture for separation technique of precipitation, solvent extraction and ion-exchange, and critical metal separation.

< Physico-Chemical Properties of Materials > (材料物性化学特論)

Assoc. Prof. T. Narita

Thermodynamics lecture of crystallization and melting properties of common materials.

< Advanced Functional Electrode > (電極機能材料化学特論)

Prof. M. Tominaga

In this lecture, we learn functionalized electrode for bioelectrochemical measurements of enzyme, protein and bio-related molecules. As the application of bioelectrochemistry we learn biosensors and biofuel cell based on an electron transfer reaction of enzyme with the functionalized electrode.

Energy and Mechanical Engineering Course

< Advanced Thermal Energy Engineering > (熱エネルギー工学特論)

Prof. A. Miyara

Finite difference method for heat transfer problems

- Conduction heat transfer
- Convection heat transfer

< Advanced Heat Engine Technology > (エネルギー機関特論)

Prof. Y. Mitsutake

- 1) Engineering Thermodynamics
- 2) Heat Conduction Problems

< Advanced Fluid Mechanics for Energy > (流体エネルギー力学特論)

Prof. Y. Kinoue

Basic theories of fluid dynamics and fluid mechanics are given in the lecture

Mechanical Systems Engineering Course

< Advanced Robotics > (ロボット工学特論)

Prof. K. Sato

- 1) Kinematics of Robot
- 2) Dynamics of Robot
- 3) Control methods of Robot

< Advanced Surface Engineering > (表面工学特論)

Prof. H. Hasegawa

- 1) Material science, processing and design
- 2) Surface science and treatment
- 3) Machine processing

< Advanced Computational Mechanics > (計算力学特論)

Prof. Y. Tadano

- 1) Mathematical foundation of computational mechanics
- 2) Nonlinear solid mechanics
- 3) Nonlinear finite element method

Electrical and Electronic Engineering Course

< Advanced Wireless Communication Systems > (ワイヤレス通信システム特論)

Prof. I. Toyoda

The main topics of this subject are as follows:

- 1) Introduction to wireless communication technologies
- 2) Fundamental technologies in wireless communications
- 3) Advanced technologies used in wireless LAN and FWA systems

< Advanced Adaptive Systems Theory > (適応システム特論)

Prof. H. Itoh

In this class, we will learn several methods for making machines that can automatically learn how to behave in unknown environments. Especially, we will learn (1) reinforcement learning, (2) stochastic modeling, and (3) optimal control in partially observable domains.

< Advanced Hardware Interface Engineering > (ハードウェア・インターフェース工学特論)

Assoc. Prof. H. Fukumoto

In this lecture, we will learn the hardware interface for computer applications. Especially, we will learn about computer architecture, Input/output interface standard, usage method, and usage example.

Civil Engineering Course

< Water Environmental System Engineering > (水環境システム工学特論)

Assoc. Prof. V. Narumol

To maintain the sustainability of water environment, it is important to recognize how nature responses to human activity. And when engineers and scientists design or plan for water environment, they should consider the phenomena in the water environment as a system. The aim of this lecture is to understand water environment using

the system engineering approach. Content of this lecture is listed below.

- 1) Basic Concept on Water-Mass Cycle Phenomena
- 2) System Approach on Water-Mass Systems (Water Quality Modeling)
- 3) Integrated Water Management and Water Policy Analysis
- 4) Interesting Issues on Water Environment in Japan and Other Countries

< Advanced Wastewater Treatment Engineering > (水処理工学特論)

Lect. Y. Mishima

Fundamental knowledges and thinking way which relate to water quality and wastewater treatment wastewater treatment will be studied firstly to obtain your understand well. Not only sewage treatment by activated sludge method, but also advanced treatments to remove nutrients, heavy metals are topics in this class.

< Advanced Geotechnical Engineering > (地盤工学特論)

Lect. T. Negami

This class presents the basic soil behavior and evaluation method of design parameters of soils. The latest ground improvement and earth reinforcement technology are introduced. Main topics of this class are as follows: 1) behavior and strength of soils, 2) laboratory testing and engineering properties of soils, 3) ground improvement technologies.

< Advanced Topics on Urban Environment > (都市環境性能特論)

Assoc. Prof. H. Li

As the progress of urbanization has more and more pronounced impacts on the urban environment, it is extremely important to systematically understand various urban environmental elements, their characteristics and problems, and to deepen our understanding of sustainable urban development. is important. In this lecture, you will acquire specialized knowledge about thermal environment problems, energy problems, waste problems, and water cycle problems in cities, and learn various techniques and methods of urban environmental planning.

Architectural Design Course

< Advanced Environmental Engineering of Architecture > (建築環境工学特論)

Prof. S. Kojima

This lecture will examine both control of indoor thermal environment and energy saving of buildings by passive cooling/heating systems and active systems. Topics of passive systems, HVAC&R systems, thermal systems, and heat load calculation methods are discussed with some practices.

Biomedical Engineering Course

< Numerical Analysis in Biomedical Engineering > (医工数値解析特論)

Prof. K. Muramatsu

Various algorithms and techniques, such as methods of solving differential equations, nonlinear equations, large scale linear equations, inverse problems, etc., on numerical analysis are lectured.

< Bioinformatics Programming > (バイオインフォマティクス特論)

Assoc. Prof. H. Douzono

In this lecture, the bioinformatics is lectured including the basic life science, informatics, and programming for bioinformatics of sequence-alignment, hidden Markov model and neural networks using C language and Python.

< Neuro-Biological Information Processing > (脳生体情報工学特論)

Prof. T. Sugi

Information processing and numerical analysis for biomedical and/or neuro-biological signals are discussed. Focus is to improve the knowledge on neurophysiological sciences and the skill for information processing of biomedical data.

Functional Biomolecular Science Course

< Advanced Biocoordination Chemistry I > (生命錯体化学特論 I)

Prof. M. Koikawa

This class introduces simple crystal field theory for transition metal complexes.

< Advanced Biocoordination Chemistry II > (生命錯体化学特論 II)

Prof. M. Koikawa

In this lecture, features of metalloprotein, such as crystal structures, magnetic properties, spectroscopies, and chemical reactions, are introduced.

< Advanced Chemical Spectroscopy I > (分光化学特論 I)

Prof. M. Unno

Basic theory of molecular spectroscopy, including molecular rotation, molecular vibration, and electronic transition, is introduced in this lecture.

< Advanced Chemical Spectroscopy II > (分光化学特論 II)

Prof. M. Unno

Applications of molecular spectroscopy, including molecular rotation, molecular vibration, and electronic transition, are introduced in this lecture.

< Advanced Bioanalytical Chemistry I > (生命分析化学特論 I)

Prof. T. Takamuku

In this lecture, instrumental analytical techniques, such as chromatography, electric analysis, thermal analysis, and electron microscope, are introduced.

< Advanced Bioanalytical Chemistry II > (生命分析化学特論 II)

Prof. T. Takamuku

Analytical methods for observation of liquids and solutions, such as spectroscopic techniques, X-ray and neutron scattering, are introduced in this lecture. The solvation structures of amino acids and proteins in solutions are discussed on the molecular scale.

Curriculum for the students of Data Science Course
(データサイエンスコース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
(A) Theory of Applied Mathematics I	応用数学特論 I	K. Handa	2					○
(A) Theory of Applied Mathematics II	応用数学特論 II	Y. Hibino	2		○			
(A) Advanced Mathematical Science I	数理科学特論 I	Y. Hibino	2				○	
(A) Advanced Mathematical Science II	数理科学特論 II	K. Handa	2			○		
(A) Advanced Numerical Analysis I	数値解析特論 I	T. Kinoshita	2					○
(A) Advanced Numerical Analysis II	数値解析特論 II	T. Kinoshita	2			○		
(A) Advanced topics in cryptography I	暗号理論特論 I	A. Iwasaki	2			○		
(A) Advanced topics in cryptography II	暗号理論特論 II	A. Iwasaki	2					○
(B) Advanced Study of Machine Learning	機械学習特論	Y. Ishimoto	2		○		○	
(B) Advanced Study of Machine Learning System	機械学習システム特論	K. Nakayama	2			○		○
(B) Advanced Lecture on Remote Sensors and Remote Sensing	実世界センシング特論	H. Okumura	2					○
(B) Advanced Lecture on Modeling of Remotely Sensed Data	実世界モデリング特論	H. Okumura	2			○		
(B) Requirements Engineering	要求工学特論	T. Kakeshita	2					
(B) Software Design	ソフトウェア設計特論	M. Ohtsuki	2					○
(B) Information System Security	情報システムセキュリティ特論	Hori, Hiroto	2		○		○	
(B) Software Quality Assurance	ソフトウェア品質保証特論	M. Ohtsuki	2			○		
Data Science Internship A	データサイエンスインターンシップA	T. Minamoto	2	intensive				
Data Science Internship B	データサイエンスインターンシップB	T. Minamoto	2	intensive				
★Advanced Study on Data Science I (Compulsory)	データサイエンス特別研究 I	Minamoto, Hiroto, Kimura, Hibino, Handa, Okumura, Hanada, Kakeshita, Yamaguchi, Matsumae, Nakayama, Fukuda, Kinoshita, Iwasaki, Hori, Otani, Ishimoto, Yeoh	5			○		○
★Advanced Study on Data Science II (Compulsory)	データサイエンス特別研究 II	same as above	5		○		○	
★Advanced Study on Data Science III (Compulsory)	データサイエンス特別研究 III	same as above	10			○		○
★Advanced Study on Data Science IV (Compulsory)	データサイエンス特別研究 IV	same as above	10		○		○	

* Master of Science: You need to earn "A" more than 4 credits in total of Core Subject and Major Subject.

* Master of Engineering: You need to earn "B" more than 4 credits in total of Core Subject and Major Subject.

Outline of Major subjects

Data Science Course

< Theory of Applied Mathematics I > (応用数学特論I)

Prof. K. Handa

Certain applications of mathematics will be explained.

< Theory of Applied Mathematics II > (応用数学特論II)

Assoc. Prof. Y. Hibino

Introduction to probability theory, especially the canonical representation of Gaussian processes.

< Advanced Mathematical Sciences I > (数理科学特論I)

Assoc. Prof. Y. Hibino

Quantum probability and its application to graph theory.

< Advanced Mathematical Sciences II > (数理科学特論II)

Prof. K. Handa

Some topics on mathematical sciences will be discussed.

< Advanced Numerical Analysis I > (数値解析特論I)

Assoc. Prof. T. Kinoshita

In this lecture, the theory of finite element method, error analysis and its implementation will be explained.

< Advanced Numerical Analysis II > (数値解析特論II)

Assoc. Prof. T. Kinoshita

In this lecture, the theory of numerical verification method and its applications will be explained.

< Advanced topics in cryptography I > (暗号理論特論I)

Assoc. Prof. A. Iwasaki

Basic concept of cryptography and security proof in the field are explained.

< Advanced topics in cryptography II > (暗号理論特論II)

Assoc. Prof. A. Iwasaki

We introduce basic concept of cryptography and particularly focus on Multi-Party Computation.

< Advanced Study of Machine Learning > (機械学習特論)

Prof. Y. Ishimoto

This lecture course focuses on fundamental aspects of machine learning and provides its mathematical basis such as probability and information theory, linear regression and classification problems. One of the goals is to understand such basis of neural networks.

< Advanced Study of Machine Learning System > (機械学習システム特論)

Prof. K. Nakayama

This class explains the fundamentals and the concepts of machine learning System.

< Advanced Lecture on Remote Sensors and Remote Sensing > (実世界センシング特論)

Prof. H. Okumura

This class aims to learn about advanced sensors and sensing systems to obtain analog data from real world to computers and to learn how to handle these data effectively through contents of lectures, investigation research and discussion.

< Advanced Lecture on Modeling of Remotely Sensed Data > (実世界モデリング特論)

Prof. H. Okumura

This class aims to learn how to acquire various information from data and images obtained by remote sensing using satellite sensors and to conduct analysis exercises using actual images and data.

< Requirements Engineering > (要求工学特論)

Assoc. Prof. T. Kakeshita

When building useful information systems, software engineers must analyze the needs of various stakeholders regarding the system and plan those that satisfy them. In addition, techniques to create complete specifications, free of ambiguities and inconsistencies, minimize the risks associated with information system development. In this course, students will learn various techniques for planning, analyzing requirements, and developing specifications for information systems.

< Software Design > (ソフトウェア設計特論)

Lect. M. Ohtsuki

In recent years, as social systems have become increasingly IT-oriented, various systems have been developed as software. The hardware and middleware that serve as the foundation for such systems have also developed, requiring in-depth knowledge of these systems in their development. In this course, students will learn the basics of design among the various knowledge and techniques required for such development in a practical manner using PBL materials.

< Information System Security > (情報システムセキュリティ特論)

Prof. Y. Hori, Assoc. Prof. M. Hiroto

This lecture introduces basic and common matters required for the construction of secure information systems. To recognize the importance of information security and information security technology, and to master the basic technologies and related laws.

< Software Quality Assurance > (ソフトウェア品質保証特論)

Lect. M. Ohtsuki

In today's world, where software is used in all aspects of society, including daily life, how to assure software quality is an important issue. Software quality assurance has been addressed since the days of rocket orbit calculations in the 1960s. In this lecture, you will learn what software quality assurance is and how to ensure quality. Then, we will learn about various techniques to assure software quality, especially testing techniques.

< Data Science Internship A > (データサイエンスインターンシップ A)

Prof. T. Minamoto

In collaboration with local governments and industries that utilize data science, the internship program provides the student with the opportunity to work in a day-to-day professional environment under the supervision of an experienced professional and with the guidance of our course staff. This program also aims to foster positive interaction between the student and experienced information management professionals in local governments, institutions, businesses, and other agencies.

< Data Science Internship B > (データサイエンスインターンシップ B)

Prof. T. Minamoto

In collaboration with local governments and industries that utilize data science, the internship program provides the student with the opportunity to work in a day-to-day professional environment under the supervision of an experienced professional and with the guidance of our course staff. This program also aims to foster positive interaction between the student and experienced information management professionals in local governments, institutions, businesses, and other agencies.

< Advanced Study on Data Science I > (データサイエンス特別研究 I)

Prof. T. Minamoto et al.

This study includes postgraduation research such as experiments, reading on research paper, and so on.

< Advanced Study on Data Science II > (データサイエンス特別研究Ⅱ)

Prof. T. Minamoto et al.

This study includes postgraduation research such as experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study on Data Science III > (データサイエンス特別研究Ⅲ)

Prof. T. Minamoto et al.

This study includes postgraduation research such as interim presentation, experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study on Data Science IV > (データサイエンス特別研究Ⅳ)

Prof. T. Minamoto et al.

This study includes postgraduation research such as presentation outside the University, experiments, reading on research paper, writing on abstracts and so on.

Curriculum for the students of Computer Science and Information Technology Course
(知能情報工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Study of Machine Learning	機械学習特論	Y. Ishimoto	2		○		○	
Advanced Study of Machine Learning System	機械学習システム特論	K. Nakayama	2			○		○
Advanced Lecture on Remote Sensors and Remote Sensing	実世界センシング特論	H. Okumura	2					○
Advanced Lecture on Modeling of Remotely Sensed Data	実世界モデリング特論	H. Okumura	2			○		
Requirements Engineering	要求工学特論	T. Kakeshita	2					
Software Design	ソフトウェア設計特論	M. Ohtsuki	2					○
Software Quality Assurance	ソフトウェア品質保証特論	M. Ohtsuki	2			○		
Advanced Study of Operating Systems	オペレーティングシステム特論	E. Hanada	2		○			
Advanced Network-based System	ネットワーク指向システム特論	M. Otani	2		○			
Advanced Information Infrastructure Systems	情報基盤システム学特論	Y. Hori	2		○			
Advanced Ubiquitous Information Environment	ユビキタス情報環境特論	M. Otani	2				○	
Advanced Parallel and Distributed Algorithms	並列分散アルゴリズム特論	S. Matsumae	2		○		○	
Modeling and Simulations	モデル化とシミュレーション特論	W.L. Yeoh	2					
High Performance Computing	高性能計算特論		2					
Information System Security	情報システムセキュリティ特論	Hori, Hirotomo	2		○		○	
★Advanced Study on Computer Science and Information Technology I (Compulsory)	知能情報工学特別研究 I	Fukuda, Hanada, Okumura, Minamoto, Kakeshita, Matsumae, Okazaki, Hieida, Nakayama, Otani, Ohtsuki, Kimura, Hirotomo, Yamaguchi, Hori, Ueda, Ishimoto, Yeoh	5			○		○
★Advanced Study on Computer Science and Information Technology II (Compulsory)	知能情報工学特別研究 II	same as above	5		○		○	
★Advanced Study on Computer Science and Information Technology III (Compulsory)	知能情報工学特別研究 III	same as above	10			○		○
★Advanced Study on Computer Science and Information Technology IV (Compulsory)	知能情報工学特別研究 IV	same as above	10		○		○	

Outline of Major Subjects

Computer Science and Information Technology Course

< Advanced Study of Machine Learning > (機械学習特論)

Prof. Y. Ishimoto

This lecture course focuses on fundamental aspects of machine learning and provides its mathematical basis such as probability and information theory, linear regression and classification problems. One of the goals is to understand such basis of neural networks.

< Advanced Study of Machine Learning System > (機械学習システム特論)

Prof. K. Nakayama

This class explains the fundamentals and the concepts of machine learning System.

< Advanced Lecture on Remote Sensors and Remote Sensing > (実世界センシング特論)

Prof. H. Okumura

This class aims to learn about advanced sensors and sensing systems to obtain analog data from real world to computers and to learn how to handle these data effectively through contents of lectures, investigation research and discussion.

< Advanced Lecture on Modeling of Remotely Sensed Data > (実世界モデリング特論)

Prof. H. Okumura

This class aims to learn how to acquire various information from data and images obtained by remote sensing using satellite sensors and to conduct analysis exercises using actual images and data.

< Requirements Engineering > (要求工学特論)

Assoc. Prof. T. Kakeshita

When building useful information systems, software engineers must analyze the needs of various stakeholders regarding the system and plan those that satisfy them. In addition, techniques to create complete specifications, free of ambiguities and inconsistencies, minimize the risks associated with information system development. In this course, students will learn various techniques for planning, analyzing requirements, and developing specifications for information systems.

< Software Design > (ソフトウェア設計特論)

Lect. M. Ohtsuki

In recent years, as social systems have become increasingly IT-oriented, various systems have been developed as software. The hardware and middleware that serve as the foundation for such systems have also developed, requiring in-depth knowledge of these systems in their development. In this course, students will learn the basics of design among the various knowledge and techniques required for such development in a practical manner using PBL materials.

< Software Quality Assurance > (ソフトウェア品質保証特論)

Lect. M. Ohtsuki

In today's world, where software is used in all aspects of society, including daily life, how to assure software quality is an important issue. Software quality assurance has been addressed since the days of rocket orbit calculations in the 1960s. In this lecture, you will learn what software quality assurance is and how to ensure quality. Then, we will learn about various techniques to assure software quality, especially testing techniques.

< Advanced Study of Operating Systems > (オペレーティングシステム特論)

Prof. E. Hanada

Practical study of operating systems as a basic element of information systems; lectures on their structure and operation and system programming (programming over system calls), using UNIX as an example.

< Advanced Network-based System > (ネットワーク指向システム特論)

Assoc. Prof. M. Otani

Use of internet-based information systems is advancing rapidly, and technology is advancing along with it. In this course, the current state of information systems and next-generation communication technologies will be introduced, while discussing future information systems.

< Advanced Information Infrastructure Systems > (情報基盤システム学特論)

Prof. Y. Hori

Information infrastructure systems are the foundations of the society in which we live. This lecture will focus on the design and operation of information infrastructure systems based on an understanding of the basic concepts of information infrastructure systems.

< Advanced Ubiquitous Information Environment > (ユビキタス情報環境特論)

Assoc. Prof. M. Otani

Ubiquitous computing refers to an environment in which computers are present everywhere in society and daily life and information can be accessed anytime, anywhere without awareness. In this course, learn about the knowledge and technologies required to structure a ubiquitous computing environment.

< Advanced Parallel and Distributed Algorithms > (並列分散アルゴリズム特論)

Prof. S. Matsumae

Fundamental algorithms and their properties are discussed along with learning about the basic models and architectures in parallel and distributed processing. Students are encouraged to deepen their understanding by solving simple exercises.

< Modeling and Simulations > (モデル化とシミュレーション特論)

Assoc. Prof. W.L. Yeoh

Fundamental concepts of modeling and computer simulations are the main theme of this lecture. Fundamental equations, phenomenological modeling and stochastic modeling are discussed in mainly physical phenomena. And numerical methods of differential equations and visualization of results, relations between continuous and discrete models, fundamentals of stochastic processes are also discussed. Understanding modeling processes enables us to understand fundamental processes and expect results.

< Information System Security > (情報システムセキュリティ特論)

Prof. Y. Hori, Assoc. Prof. Hirotomo

This lecture introduces basic and common matters required for the construction of secure information systems. To recognize the importance of information security and information security technology, and to master the basic technologies and related laws.

< Advanced Study on Computer Science and Information Technology I - IV > (知能情報工学特別研究 I ~IV)

Prof. S. Matsumae etc.

The purposes of this series of lectures are cultivating fundamental research skills, such as reading academic papers and developing codes. Skills for conducting research and communication are improved through discussion in seminars with mentors and colleagues.

Curriculum for the students of Advanced Materials Chemistry Course
 (機能材料化学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Fundamental Material Chemistry	機能材料化学基礎特論	Ohto,Takeshita,Tominaga,Yamada,Era,Kawakita,Kodama,Sakaguchi,Narita,Morisada,Yada	2			○		○
Applied Material Chemistry	機能材料化学特論	same as above	2		○		○	
Advanced Material Chemistry	機能材料化学応用特論	same as above	2			○		○
Advanced Materials Chemistry of Coordination Compounds	錯体材料化学特論	Y. Yamada	2		○		○	
Advanced Inorganic Material Chemistry	無機材料化学特論		2					
Organic Reaction Mechanism	反応有機化学特論		2					
Physical Organic Chemistry	物性有機化学特論	M. Takeshita	2		○		○	
Physical Chemistry of Polymers	高分子物理化学特論	T. Narita	2			○		
Optoelectronic Material Chemistry	光電子機能材料化学特論	M. Era	2					
Physical Chemistry of Condensed Matter	物性物理化学特論	K. Sakaguchi	2			○		○
Advanced Mass Transfer	物質移動特論	H. Kawakita	2		○		○	
★Advanced Study in Applied Material Chemistry I (Compulsory)	機能材料化学特別研究 I	Ohto,Takeshita,Tominaga,Yamada,Era,Kawakita,Kodama,Sakaguchi,Narita,Morisada,Yada	5			○		○
★Advanced Study in Applied Material Chemistry II (Compulsory)	機能材料化学特別研究 II	same as above	5		○		○	
★Advanced Study in Applied Material Chemistry III (Compulsory)	機能材料化学特別研究Ⅲ	same as above	10			○		○
★Advanced Study in Applied Material Chemistry IV (Compulsory)	機能材料化学特別研究Ⅳ	same as above	10		○		○	

Outline of Major subjects

Advanced Materials Chemistry Course

< Fundamental Material Chemistry > (機能材料化学基礎特論)

Prof. K. Ohto et al.

This class includes lectures on students' own specialties for each research field such as inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry and chemical engineering with small class.

< Applied Material Chemistry > (機能材料化学特論)

Prof. K. Ohto et al.

Research activities on students' own research topics such as, references investigation, etc. are carried out.

< Advanced Material Chemistry > (機能材料化学応用特論)

Prof. K. Ohto et al.

This class includes lectures on advanced chemical topics with omnibus class.

< Advanced Materials Chemistry of Coordination Compounds > (錯体材料化学特論)

Prof. Y. Yamada

A course mainly deals with structures and electronic transitions of coordination compounds.

< Advanced Inorganic Material Chemistry > (無機材料化学特論)

A course mainly deals with applications of ceramics.

< Organic Reaction Mechanism > (反応有機化学特論)

A course mainly deals with highly-stereoselective organic reaction (chemoselectivity, regioselectivity, diastereoselectivity, enantioselectivity).

< Physical Organic Chemistry > (物性有機化学特論)

Prof. M. Takeshita

In this class, the basics of organic functional materials, systems for liquid crystal and organic light emitted diodes, and molecular recognitions including molecular machines will be lectured. Knowledge of fundamental organic chemistry is necessary.

< Physical Chemistry of Polymers > (高分子物理化学特論)

Assoc. Prof. T. Narita

A seminar of selected topics in physical chemistry of polymers. Topics vary from year to year and may include statistical chain, polymer solution, polymeric gel, rubber elasticity and crystallization of polymers.

< Optoelectronic Material Chemistry > (光電子機能材料化学特論)

Assoc. Prof. M. Era

Physical chemistry of molecular materials for electronics and photonics

< Physical Chemistry of Condensed Matter > (物性物理化学特論)

Assoc. Prof. K. Sakaguchi

This class includes lectures on group theory for material science, which is related to various chemical properties such as vibrational spectroscopy, molecular orbital and so on.

< Advanced Mass Transfer > (物質移動特論)

Prof. H. Kawakita

This class includes the mass transfer with fluid behavior that is important in reaction and separation engineering.

< Advanced Study in Applied Material Chemistry I > (機能材料化学特別研究 I)

Prof. H. Kawakita et al.

This study includes postgraduation research such as experiments, reading on research paper, and so on.

< Advanced Study in Applied Material Chemistry II > (機能材料化学特別研究II)

Prof. H. Kawakita et al.

This study includes postgraduation research such as experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study in Applied Material Chemistry III > (機能材料化学特別研究III)

Prof. H. Kawakita et al.

This study includes postgraduation research such as interim presentation, experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study in Applied Material Chemistry IV > (機能材料化学特別研究IV)

Prof. H. Kawakita et al.

This study includes postgraduation research such as presentation outside the University, experiments, reading on research paper, writing on abstracts and so on.

Curriculum for the students of Energy and Mechanical Engineering Course
 (機械エネルギー工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Fluid Engineering	流体工学特論	S. Matsuo	2			○		
Advanced Thermodynamics	熱力学特論	K. Ishida	2			○		○
Advanced Mechanics of Materials	材料力学特論	N. Hattori	2			○		
Advanced Dynamics of Machinery	機械力学特論		2					
Advanced Mechanical Engineering PBL	機械システム工学PBL	S. Hagihara etc.	2		○		○	
Advanced Instrument and Control Engineering	計測制御特論	K. Sato	2			○		○
Advanced Heat Transport Engineering	熱輸送工学特論	K. Kariya	2			○		○
Advanced Heat and Mass Transfer	熱物質移動工学特論	H. Arima	2			○		○
Advanced Fluid Energy	流体エネルギー特論	N. Shiomi	2		○		○	
Advanced Fluid System Engineering	流動システム工学特論	W. Tsuru	2		○		○	
Advanced Ocean Engineering	海洋工学特論		2					
Advanced Offshore Wind Turbine Engineering	洋上風車工学特論	S. Yoshida	2		○		○	
Advanced Energy Conversion	エネルギー変換特論	Y. Ikegami	2			○		○
Advanced Ocean Measurement	海洋環境特論	Y. Imai	2			○		○
★Advanced Study in Mechanical and Energy Engineering I (Compulsory)	機械エネルギー工学特別研究Ⅰ	Ishida,Ikegami,Kinoue,Matsuo,Mitsutake,Miyara,Arima,Imai,Kariya,Shiomi,Murakami,Yoshida,Tsuru	5			○		○
★Advanced Study in Mechanical and Energy Engineering II (Compulsory)	機械エネルギー工学特別研究Ⅱ	same as above	5		○		○	
★Advanced Study in Mechanical and Energy Engineering III (Compulsory)	機械エネルギー工学特別研究Ⅲ	same as above	10			○		○
★Advanced Study in Mechanical and Energy Engineering IV (Compulsory)	機械エネルギー工学特別研究Ⅳ	same as above	10		○		○	

Outline of Major subjects

Energy and Mechanical Engineering Course

< Advanced Fluid Engineering > (流体工学特論)

Prof. S. Matsuo

- 1) Fundamental Fluid Dynamics.
- 2) Shock Wave Phenomena.
- 3) Effective Utilization of Fluid Energy.
- 4) Application to Biomedical Fluid Engineering.

< Advanced Thermodynamics > (熱力学特論)

Lect. K. Ishida

Lectures on advanced applications of thermodynamics to energy conversion and energy transfer processes.

< Advanced Mechanics of Materials > (材料力学特論)

Prof. N. Hattori

- 1) Stresses in the elastic range
- 2) Fracture mechanics
- 3) Preventing mechanical failure.

< Advanced Dynamics of Machinery > (機械力学特論)

- 1) Dynamics of Rigid Machines
- 2) Nonlinear Dynamics Analysis
- 3) Linked Structure Dynamics Applications

< Advanced Mechanical Engineering PBL > (機械システム工学 PBL)

Prof. S. Hagihara etc.

- 1) Exercise for understanding of problems of companies
- 2) Exercise for finding solution of problems of companies

< Advanced Instrument and Control Engineering > (計測制御特論)

Prof. K. Sato

- 1) Classical Control Theory
- 2) Modern Control Theory
- 3) Robust Control Theory

< Advanced Heat Transport Engineering > (熱輸送工学特論)

Assoc. Prof. K. Kariya

- 1) The first and second law of thermodynamics
- 2) Phase equilibrium
- 3) Analysis of heat engines

< Advanced Heat and Mass Transfer > (熱物質移動工学特論)

Assoc. Prof. H. Arima

- 1) Basic of Mass Transfer
- 2) Analysis of Fundamental Equation for Heat and Mass Transfer
- 3) Problem on Boundary Layers of Heat and Mass Transfer

< Advanced Fluid Energy > (流体エネルギー特論)

Assoc. Prof. N. Shiomi

- 1) Turbomachinery
- 2) Experimental Fluid Dynamics

< Advanced Fluid System Engineering > (流動システム工学特論)

Asst. Prof. W. Tsuru

- 1) Computational fluid dynamics
- 2) Finite element method for structure analysis
- 3) Fluid Structure Interaction

< Advanced Ocean Engineering > (海洋工学特論)

- 1) Ocean Energy Systems
- 2) Engineering of Seawater Desalination

< Advanced Offshore Wind Turbine Engineering > (洋上風車工学特論)

Prof. S. Yoshida

- 1) Modeling and analysis methods of wind turbines
- 2) Fundamental design procedures of wind turbines
- 3) Social values of wind turbines

< Advanced Energy Conversion > (エネルギー変換特論)

Prof. Y. Ikegami

- 1) Optimization of Energy System
- 2) Ocean Thermal Energy Conversion
- 3) Exergy of Energy System

< Advanced Ocean Measurement > (海洋環境特論)

Assoc. Prof. Y. Imai

< Advanced Study in Mechanical and Energy Engineering I > (機械エネルギー工学特別研究Ⅰ)

Prof. Y. Mitsutake etc.

- Understand the background and significance of research.
- Learn knowledge necessary for conducting research and develop research basis.

< Advanced Study in Mechanical and Energy Engineering II > (機械エネルギー工学特別研究Ⅱ)

Prof. Y. Mitsutake etc.

- Conduct experiment and/or theoretical analysis and/or numerical simulation.
- Consider obtained results and present to other students and teachers.

< Advanced Study in Mechanical and Energy Engineering III > (機械エネルギー工学特別研究Ⅲ)

Prof. Y. Mitsutake etc.

- Review related literature and acquire broad understanding of research.
- Understand obtained results deeply by discussion with other students and teachers.

< Advanced Study in Mechanical and Energy Engineering IV > (機械エネルギー工学特別研究Ⅳ)

Prof. Y. Mitsutake etc.

- Develop original idea for study and summarize study results.
- Write Master thesis and give final presentation.

Curriculum for the students of Mechanical Systems Engineering Course
 (機械システム工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Fluid Engineering	流体工学特論	S. Matsuo	2			○		
Advanced Thermodynamics	熱力学特論	K. Ishida	2			○		○
Advanced Mechanics of Materials	材料力学特論	N. Hattori	2			○		
Advanced Dynamics of Machinery	機械力学特論		2					
Advanced Mechanical Engineering PBL	機械システム工学PBL	S. Hagihara etc	2		○		○	
Advanced Instrument and Control Engineering	計測制御特論	K. Sato	2			○		○
Advanced Materials Science for Engineers	機械材料学特論	S. Morita	2			○		○
Advanced Precision Machine	精密機器工学特論		2					
Advanced Lubrication Engineering	潤滑工学特論	T. Mawatari	2		○		○	
Advanced Applied Dynamics	応用力学特論		2					
Advanced Manufacturing Processes	生産加工学特論	F. Ohshima	2		○		○	
Advanced Solid Mechanics	固体力学特論	S. Hagihara	2			○		○
Advanced Strength of Materials	材料強度学特論	S. Taketomi	2			○		○
★Advanced Study in Mechanical and System Engineering I (Compulsory)	機械システム工学特別研究 I	Sato,Hagihara,Hattori,Ohshima,Taketomi,Tadano,Hasegawa,Mawatari,Morita	5			○		○
★Advanced Study in Mechanical and System Engineering II (Compulsory)	機械システム工学特別研究 II	same as above	5		○		○	
★Advanced Study in Mechanical and System Engineering III (Compulsory)	機械システム工学特別研究 III	same as above	10			○		○
★Advanced Study in Mechanical and System Engineering IV (Compulsory)	機械システム工学特別研究 IV	same as above	10		○		○	

Outline of Major subjects

Mechanical Systems Engineering Course

< Advanced Fluid Engineering > (流体工学特論)

Prof. S. Matsuo

- 1) Fundamental Fluid Dynamics.
- 2) Shock Wave Phenomena.
- 3) Effective Utilization of Fluid Energy.
- 4) Application to Biomedical Fluid Engineering.

< Advanced Thermodynamics > (熱力学特論)

Lect. K. Ishida

Lectures on advanced applications of thermodynamics to energy conversion and energy transfer processes.

< Advanced Mechanics of Materials > (材料力学特論)

Prof. N. Hattori

- 1) Stresses in the elastic range
- 2) Fracture mechanics
- 3) Preventing mechanical failure.

< Advanced Dynamics of Machinery > (機械力学特論)

- 1) Dynamics of Rigid Machines
- 2) Nonlinear Dynamics Analysis
- 3) Linked Structure Dynamics Applications

< Advanced Mechanical Engineering PBL > (機械システム工学 PBL)

Prof. S. Hagihara etc.

- 1) Exercise for understanding of problems of companies
- 2) Exercise for finding solution of problems of companies

< Advanced Instrument and Control Engineering > (計測制御特論)

Prof. K. Sato

- 1) Classical Control Theory
- 2) Modern Control Theory
- 3) Robust Control Theory

< Advanced Materials Science for Engineers > (機械材料学特論)

Assoc. Prof. S. Morita

- 1) Microstructural feature of materials
- 2) Phase diagrams of ferrous and non-ferrous metallic materials
- 3) Mechanical properties of industrial materials

< Advanced Precision Machine > (精密機器工学特論)

- 1) Principle of Ultra-Precision Machining
- 2) Developments in Ultra-Precision Machining
- 3) Machine Tools for Ultra-Precision Machining

< Advanced Lubrication Engineering > (潤滑工学特論)

Assoc. Prof. T. Mawatari

- 1) Principle of Lubrication
- 2) Lubrication Regimes
- 3) Mechanisms of Fluid Lubrication

< Advanced Applied Dynamics > (応用力学特論)

The purpose of this subject is dynamical analyses of various phenomena in mechanical systems.

< Advanced Manufacturing Processes > (生産加工学特論)

Assoc. Prof. F. Ohshima

- 1) Principle of Machine Tools
- 2) Theory of Manufacturing Processes
- 3) Computer Graphics for Manufacturing Processes

< Advanced Solid Mechanics > (固体力学特論)

Prof. S. Hagihara

- 1) Solid mechanics
- 2) Finite Element Method
- 3) Computational Mechanics of Solids

< Advanced Strength of Materials > (材料強度学特論)

Prof. S. Taketomi

- 1) Strength of materials and kinds of failure
- 2) Some fractographic studies and their mechanisms
- 3) Initiation and propagation of fatigue cracks
- 4) Case studies and analysis of failure etc.

< Advanced Study in Mechanical and System Engineering I > (機械システム工学特別研究 I)

Prof. Y. Tadano etc.

- Understand the background and significance of research.
- Learn knowledge necessary for conducting research and develop research basis.

< Advanced Study in Mechanical and System Engineering II > (機械システム工学特別研究 II)

Prof. Y. Tadano etc.

- Conduct experiment and/or theoretical analysis and/or numerical simulation.
- Consider obtained results and present to other students and teachers.

< Advanced Study in Mechanical and System Engineering III > (機械システム工学特別研究 III)

Prof. Y. Tadano etc.

- Review related literature and acquire broad understanding of research.
- Understand obtained results deeply by discussion with other students and teachers.

< Advanced Study in Mechanical and System Engineering IV > (機械システム工学特別研究 IV)

Prof. Y. Tadano etc.

- Develop original idea for study and summarize study results.
- Write Master thesis and give final presentation.

Curriculum for the students of Electrical and Electronic Engineering Course

(電気電子工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Quantum Opto-electronics	光量子エレクトロニクス特論	Q. Guo	2		○		○	
Advanced Integrated Circuit Process Engineering	集積回路プロセス工学特論	T. Tanaka	2			○		○
Electronic System Design and Integration Technology	電子情報システム設計特論		2					
Microwave Integrated Circuits	マイクロ波集積回路特論	T. Ohishi	2			○		
Advanced Utilization of Synchrotron Light	シンクロトロン光利用科学技術工学特論	K. Takahashi	2		○		○	
Advanced Engineering of Computational Intelligence	計算論的知能工学特論	H. Wakuya	2			○		○
Advanced Processing Plasma Engineering	プロセスプラズマ工学特論	Y. Ohtsu	2			○		○
Advanced Pulsed Power Engineering	パルスパワー工学特論	S. Ihara	2		○		○	
Advanced Semiconductor Device Engineering	半導体デバイス工学特論	M. Kasu	2		○		○	
Microwave Circuit Design Engineering	高周波回路設計特論	T. Tanaka	2		○		○	
Advanced Data Analysis Engineering	データ解析工学特論	S. Hara	2		○		○	
Advanced New & Saved Energy Engineering	新・省エネルギー工学特論	E. Nishiyama	2		○		○	
Advanced Electrical and Electronic Engineering	電気電子工学特論		2					
Education as Electrical and Electronic Business-person	電気電子実務者教育特論		2					
★Advanced Study in Electrical and Electronic Engineering I (Compulsory)	電気電子工学特別研究 I	Toyoda,Kasu,Ohishi,Ohtsu,Tanaka,Guo,Ihara,Hara,Wakuya,Tanaka,Itoh,Fukumoto,Nishiyama,Takahashi, Saito	5			○		○
★Advanced Study in Electrical and Electronic Engineering II (Compulsory)	電気電子工学特別研究 II	same as above	5		○		○	
★Advanced Study in Electrical and Electronic Engineering III (Compulsory)	電気電子工学特別研究 III	same as above	10			○		○
★Advanced Study in Electrical and Electronic Engineering IV (Compulsory)	電気電子工学特別研究 IV	same as above	10		○		○	

Outline of Major subjects

Electrical and Electronic Engineering Course

< Advanced Quantum Opto-electronics > (光量子エレクトロニクス特論)

Prof. Q. Guo

The aim of this course is to give fundamental knowledge on various physical processes of optoelectronic transition, in order to understand technologies for applications in light emitting diodes, detectors, and solar energy conversion devices

< Advanced Integrated Circuit Process Engineering > (集積回路プロセス工学特論)

Prof. T. Tanaka

This subject starts with an introduction of physics and properties of semiconductors and fundamentals of pn-junction, followed by a generic overview of MOSFET and bipolar transistor. Integrated circuit process technologies including crystal growth, oxidation, thin film growth, thermal diffusion, ion implantation, lithography, and etching will be introduced.

< Electronic System Design and Integration Technology > (電子情報システム設計特論)

The main topics of this subject are as follows:

- 1) Introduction to Packaging Technology for High-Speed Information equipment
- 2) Noise of the power supply line
- 3) Cross-talk Noise
- 4) Cooling technology
- 5) IC package and packaging technology
- 6) Interconnection technology for high speed signal
- 7) Multi chip Module technology

< Microwave Integrated Circuits > (マイクロ波集積回路特論)

Prof. T. Ohishi

High frequency and high power amplifier used in microwave integrated circuits for radar and radio frequency communication system is mainly lectured.

The topics of this lecture are as follows:

1. semiconductor devices for microwave integrated circuit
2. microwave integrated circuit components
3. high frequency power amplifier

< Advanced Utilization of Synchrotron Light > (シンクロトロン光利用科学技術工学特論)

Prof. K. Takahashi

Basic aspects on synchrotron light application, such as synchrotron light source, beamline, X-ray detection, ultra-high-vacuum, and experimental methods will be reviewed, in order to understand the scientific and industrial application of synchrotron light.

< Advanced Engineering of Computational Intelligence > (計算論的知能工学特論)

Prof. H. Wakuya

Brain is one of the keywords of the 21st century. As an approach to investigate its mysterious functions, fundamental knowledge on computational intelligence is discussed. Also, recent topics of neurocomputing technology, biomedical engineering and welfare engineering are dealt with.

< Advanced Processing Plasma Engineering > (プロセスプラズマ工学特論)

Prof. Y. Ohtsu

Fundamental characteristics are introduced for processing plasma engineering. Ionized gas production methods such as DC, AC, RF and microwave discharges are lectured. The plasma applications are also explained.

< Advanced Pulsed Power Engineering > (パルスパワー工学特論)

Assoc. Prof. S. Ihara

- 1) Fundamentals of energy storage and pulsed power generation.

- 2) Pulse forming networks, switching devices.
- 3) Applications of pulsed power technology.

< Advanced Semiconductor Device Engineering > (半導体デバイス工学特論)

Prof. M. Kasu

In order to realize energy sustainable society, high-efficient power transistors are necessary. For the purpose, widegap semiconductors such as SiC, GaN, diamond are lectured.

< Microwave Circuit Design Engineering > (高周波回路設計特論)

Assoc. Prof. T. Tanaka

In this lecture, first, students learn theory of transmission line and a method to use smith chart. Next, students learn theory of high frequency active device and circuit by a standard schooling style.

< Advanced Data Analysis Engineering > (データ解析工学特論)

Assoc. Prof. S. Hara

The structure and mechanism of photovoltaic systems are explained. Data analysis in photovoltaic power systems is also discussed.

< Advanced New & Saved Energy Engineering > (新・省エネルギー工学特論)

Assoc. Prof. E. Nishiyama

- 1) Fundamentals of wireless energy transfer.
- 2) Wireless power transfer using Microwave.
- 3) Wireless power transfer via magnetic resonance coupling.

< Advanced Electrical and Electronic Engineering > (電気電子工学特論)

< Advanced as Electrical and Electronic Business-person > (電気電子実務者教育特論)

< Advanced Study in Electrical and Electronic Engineering I > (電気電子工学特別研究 I)

Prof. H. Itoh etc.

< Advanced Study in Electrical and Electronic Engineering II > (電気電子工学特別研究 II)

Prof. H. Itoh etc.

< Advanced Study in Electrical and Electronic Engineering III > (電気電子工学特別研究 III)

Prof. H. Itoh etc.

< Advanced Study in Electrical and Electronic Engineering IV > (電気電子工学特別研究 IV)

Prof. H. Itoh etc.

Curriculum for the students of Civil Engineering Course
(都市基盤工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Applied Fluid Mechanics	応用流体力学特論	H. Oshikawa	2		○			
Advanced Structural Engineering	構造工学特論	M. Nizam	2			○		○
Urban Development and Urban Systems	都市構成システム論	T. Inohae	2				○	
International Seminar for Urban Environment and Urban Planning	国際都市・環境特別演習	N. Mishima etc.	2	Intensive				
Advanced Hydraulics	水工学特論	K. Ohgushi	2					
Advanced Hydroinformatics	水環境情報学特論	K. Ohgushi	2			○		
Advanced Environmental Transport Phenomena	環境輸送特論	H. Yamanishi	2					
Advanced Geo-sphere Environmental Engineering in Lowland	低平地地圏環境学特論	T. Hino	2					○
Advanced Nonlinear Structural Analysis	非線形構造解析学特論	H. Obiya	2			○		
Advanced Construction Materials	建設材料学特論	Y. Itoh	2			○		
Advanced Architectural Environmental Design	建築環境設計特論	K. Nakaohkubo	2			○		
★Advanced Study in Civil Engineering I (Compulsory)	都市基盤工学特別研究 I	Ohgushi,Itoh,Hino,N.Mishima,Obiya,Kojima,Yamanishi,Oshikawa,Narumol,Goto,Li,Inohae,Nakaohkubo,Miyahara,Negami,Y.Mishima,Fuchikami	5			○		○
★Advanced Study in Civil Engineering II (Compulsory)	都市基盤工学特別研究 II	same as above	5		○		○	
★Advanced Study in Civil Engineering III (Compulsory)	都市基盤工学特別研究 III	same as above	10			○		○
★Advanced Study in Civil Engineering IV (Compulsory)	都市基盤工学特別研究 IV	same as above	10		○		○	

Outline of Major Subjects

Civil Engineering Course

< Advanced Applied Fluid Mechanics > (応用流体力学特論)

Prof. H. Oshikawa

Theories and equations expressing flow phenomena, advection and diffusion transport and waves are described: 1) Navier-Stokes equation, 2) Reynolds equation, 3) advection diffusion equation, 4) the small amplitude wave theory. In addition, statistical properties of water surface waves and turbulence, which are representative irregular phenomena in hydraulics, will be explained.

< Advanced Structural Engineering > (構造工学特論)

Assoc. Prof. M. Nizam

Structural analysis is one of the important subjects in civil engineering course especially in structural engineering fields. This course introduces students to the advanced topics in structural analysis. Scope of study includes yield line theory, indeterminate structure, elastic instability, plastic analysis and structural analysis using stiffness method.

< Urban Development and Urban Systems > (都市構成システム論)

Assoc. Prof. T. Inohae

I lecture on a principle of the constitution of the city and the constitution idea about the system, theory and system model. After having grasped a constitution principle and the theory becoming basic of this lecture, I introduce in particular various results of research to be concerned with a component and the sustained constitution system which my laboratory carried out so far. These researches are related to the idea of the sustainable development city closely. I let you understand importance and charm of the approach from a research side for the city constitution and sustainable city, and furthermore in this way develop discussion.

< International Seminar for Urban Environment and Urban Planning > (国際都市・環境特別演習)

Prof. N. Mishima etc.

< Advanced Hydraulics > (水工学特論)

Prof. K. Ohgushi

Fundamental matters on the finite difference method necessary for civil engineers to perform hydraulic calculations are lectured. First, the fundamentals of the finite difference method are outlined. Then, the basic formulas of integral form and differential form based on the assumption of Saint Venant for one-dimensional open channel flow are derived. Various finite difference methods for the basic equations are introduced. We discuss the numerical stability of calculation method. Finally, lecture on applied matters such as numerical calculation of the sedimentation in the river and diffusion of dissolved matters in the water body.

< Advanced Hydroinformatics > (水環境情報学特論)

Prof. K. Ohgushi

By effectively obtaining and utilizing the information of water environment in the watershed and the coastal area, it can be possible to grasp our surrounding water environment appropriately and to connect to the disaster prevention, water use and creation of environment being symbiotic to the nature. In this lecture, you can learn the applied technology of remote sensing and GIS related to water environment and comprehension of the phenomena using the computational simulation and how to use it. The necessary knowledge and technique to effectively obtain and utilize the information of water environment in future will be lectured for the student of the master course of the field of Civil Engineering and Architecture.

< Advanced Environmental Transport Phenomena > (環境輸送特論)

Prof. H. Yamanishi

This lecture picks up a system approach in formulating and analyzing environmental phenomena. Basically, those phenomena that occur in environmental systems are described and formulated. In addition, natural environmental topics recognized as being most important are included. The lecture's contents can be grouped in the following chapters:

- 1) Physical Phenomena.
- 2) Chemical Phenomena.
- 3) Biologic Phenomena and Ecological Systems.

< Advanced Geo-sphere Environmental Engineering in Lowland > (低平地地圏環境学特論)

Prof. T. Hino

We will learn the contents based on the geosphere's viewpoint in the lowland. Regarding the definition of the lowland, it is not only that the altitude of the land is low, but also that the land is susceptible to damage and environmental degradation due to the threat of water level fluctuation. The lecture is carried out by active learning called Project Based Learning (or Research Based Education). Throughout the lecture period, the following contents are practiced: 1) Providing topic by the teacher in charge; 2) Topic selection; 3) Research; 4) Results summary; 5) Presentation.

< Advanced Nonlinear Structural Analysis > (非線形構造解析学特論)

Prof. H. Obiya

Application of non-linear theories for static and dynamic analyses is mainly lectured. Latest topics in this field will be focused. To take this class, fundamental knowledge and ability of structural mechanics is required.

< Advanced Construction Materials > (建設材料学特論)

Prof. Y. Ito

This lecture introduces the recent topics on the cement, concrete, metal and construction waste. Attending a lecture should have the knowledge on concrete engineering and reinforced concrete in undergraduate program.

< Advanced Architectural Environmental Design > (建築環境設計特論)

Assoc. Prof. K. Nakaohkubo

This lecture introduces the design methods of environmental conscious buildings. In this lecture, the passive design methods, such as solar thermal heating system, the use of winds, greenery and so on, are explained mainly. Then, students make a presentation of the environmental conscious design in actual buildings based on their literature searching.

< Advanced Study in Civil Engineering I - IV > (都市基盤工学特別研究 I ～IV)

Prof. K. Ohgushi etc.

The course unit is designed to provide students with a structured approach to understanding modern civil engineering problems. Students will cover theoretical concepts and practical works related to urban management, safety management, environment and sustainability. Their knowledge of these concepts will be developed further through a series of four steps (I ～IV) that are to be undertaken through a ‘recent study’

Curriculum for the students of Architectural Design Course
(建築環境デザインコース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Exercise of Architecture and Environmental Design I	建築環境デザイン特別演習 I	N. Mishima	3			○		○
Advanced Exercise of Architecture and Environmental Design II	建築環境デザイン特別演習 II	R. Goto etc.	3		○		○	
Urban Development and Urban Systems	都市構成システム論	T. Inohae	2				○	
International Seminar for Urban Environment and Urban Planning	国際都市・環境特別演習	N. Mishima etc.	2	Intensive				
Advanced Exercise of Community Design and Architecture	地域デザイン特別演習	R. Goto M. Miyahara	2					
Advanced Urban Design	都市デザイン特論	N. Mishima	2			○		○
Advanced Architectural Environmental Design	建築環境設計特論	K. Nakaohkubo	2			○		
Psychological Theory for Architecture and Urban Spaces	建築都市空間論	M. Miyahara	2			○		○
Advanced Dwelling Environment	住環境論	R. Goto	2			○		
Advanced Architectural History	建築史特論	T. Fuchikami	2		○		○	
Advanced Geo-sphere Environmental Engineering in Lowland	低平地地圏環境学特論	T. Hino	2					○
Advanced Nonlinear Structural Analysis	非線形構造解析学特論	H. Obiya	2			○		
Advanced Structural Engineering	構造工学特論	M. Nizam	2			○		○
Advanced Construction Materials	建設材料学特論	Y. Itoh	2			○		
★Advanced Study in Architecture and Environmental Design I (Compulsory)	建築環境デザイン特別研究 I	Ohgushi,Itoh,Hino,N.Mishima,Obiya,Kojima,Yamani shi,Oshikawa,Narumol,Goto,Li,Inohae,Nakaohkubo,Miyahara,Negami,Y.Mishima,Fuchikami	5			○		○
★Advanced Study in Architecture and Environmental Design II (Compulsory)	建築環境デザイン特別研究 II	same as above	5		○		○	
★Advanced Study in Architecture and Environmental Design III (Compulsory)	建築環境デザイン特別研究 III	same as above	10			○		○
★Advanced Study in Architecture and Environmental Design IV (Compulsory)	建築環境デザイン特別研究 IV	same as above	10		○		○	

Outline of Major Subjects

Architectural Design Course

< Advanced Exercise of Architecture and Environmental Design I > (建築環境デザイン特別演習 I)

Prof. N. Mishima

This exercise consists of two assignments regarding architecture and urban design. The first assignment is a project-type practice to design and propose an attractive idea for activation of a site. The second assignment is to submit an idea to a competition for architectural and urban design student hosted by Japan Institute of Architecture.

< Advanced Exercise of Architecture and Environmental Design II > (建築環境デザイン特別演習 II)

Prof. R. Goto etc.

As a graduate course in architectural design practice, and challenge them to architectural practice and project proposals. Basic knowledge of architectural planning space design, the goal is to acquire the ability to propose the idea of architectural space for new life and new public service through exercises. As the theme of practical projects, learning from the process of planning and problem solving suggestions.

< Urban Development and Urban Systems > (都市構成システム論)

Assoc. Prof. T. Inohae

I lecture on a principle of the constitution of the city and the constitution idea about the system, theory and system model. After having grasped a constitution principle and the theory becoming basic of this lecture, I introduce in particular various results of research to be concerned with a component and the sustained constitution system which my laboratory carried out so far. These researches are related to the idea of the sustainable development city closely. I let you understand importance and charm of the approach from a research side for the city constitution and sustainable city, and furthermore in this way develop discussion.

< International Seminar for Urban Environment and Urban Planning > (国際都市・環境特別演習)

Prof. N. Mishima etc.

< Advanced Exercise of Community Design and Architecture > (地域デザイン特別演習)

Prof. R. Goto, Assoc. Prof. M. Miyahara

Modern architectural planning and town planning are demanded the relations of community and material network in the surrounding architecture. This exercise is analysis and makes a presentation about such a community design and architecture in the existential field.

< Advanced Urban Design > (都市デザイン特論)

Prof. N. Mishima

URBAN DESIGN is a complex interdisciplinary field that encompasses architecture, landscape architecture, urban planning, civil and transportation engineering, psychology, real estate development, law and other specialties. Main part of this course is analysis and discussion about such urban design processes, dealing with several examples of urban design and developments in the world.

< Advanced Architectural Environmental Design > (建築環境設計特論)

Assoc. Prof. K. Nakaohkubo

This lecture introduces the design methods of environmental conscious buildings. In this lecture, the passive design methods, such as solar thermal heating system, the use of winds, greenery and so on, are explained mainly. Then, students make a presentation of the environmental conscious design in actual buildings based on their literature searching.

< Psychological Theory for Architecture and Urban Spaces > (建築都市空間論)

Assoc. Prof. M. Miyahara

Environmental psychology has developed as psychological research to alleviate the negative impact on the human life brought by the redevelopment of the city and economic growth after the 1960s. In the field of architecture, it developed as a framework to understand the relationship between human's behavior and the environment. In this class, we will learn how we can understand the architecture and cities from the view of environmental

psychology.

< Advanced Dwelling Environment > (住環境論)

Prof. R. Goto

In this lecture, topics of dwelling environment are discussed mainly from the viewpoints of natural condition, specific condition and living condition

- 1) Formation of traditional house and residence in rural and urban area.
- 2) Problems and further needs for actual development and its planning.

< Advanced Architectural History > (建築史特論)

Asst. Prof. T. Fuchikami

In this lecture, we will deepen our understanding of the history of architecture, with a particular focus on explaining the historical development of residential architecture in modern Japan.

< Advanced Geo-sphere Environmental Engineering in Lowland > (低平地地圏環境学特論)

Prof. T. Hino

We will learn the contents based on the geosphere's viewpoint in the lowland. Regarding the definition of the lowland, it is not only that the altitude of the land is low, but also that the land is susceptible to damage and environmental degradation due to the threat of water level fluctuation. The lecture is carried out by active learning called Project Based Learning (or Research Based Education). Throughout the lecture period, the following contents are practiced: 1) Providing topic by the teacher in charge; 2) Topic selection; 3) Research; 4) Results summary; 5) Presentation.

< Advanced Nonlinear Structural Analysis > (非線形構造解析学特論)

Prof. H. Obiya

Application of non-linear theories for static and dynamic analyses is mainly lectured. Latest topics in this field will be focused. To take this class, fundamental knowledge and ability of structural mechanics is required.

< Advanced Structural Engineering > (構造工学特論)

Assoc. Prof. M. Nizam

Main part of the lecture is geometrically and/or materially nonlinear structural analysis by the tangent stiffness method.

- 1) Concept of the method.
- 2) Application to axial member structures.
- 3) Application to bending member structures.
- 4) Application to shell structures.
- 5) Application to form finding.

< Advanced Construction Materials > (建設材料学特論)

Prof. Y. Itoh

This lecture introduces the recent topics on the cement, concrete, metal and construction waste. Attending a lecture should have the knowledge on concrete engineering and reinforced concrete in undergraduate program.

< Advanced Study in Architecture and Environmental Design I - IV > (建築環境デザイン特別研究 I ~ IV)

Prof. R. Goto etc.

The course unit is designed to provide students with a structured approach to understanding modern architecture and urban design problems. Students will cover theoretical concepts and practical works related to urban design, city planning, safety management and habitat environment. Their knowledge of these concepts will be developed further through a series of four steps (I ~ IV) that are to be undertaken through a 'recent study'

Curriculum for the students of Biomedical Engineering Course
 (生体医工学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Biomedical Engineering Special Lecture I	生体医工学特別講義 I	Course Teachers	2		○		○	
Biomedical Engineering Special Lecture II	生体医工学特別講義 II	Course Teachers	2		○	○	○	○
Dynamics in Biomedical Engineering	医工力学特論	T. I. Khan	2			○		○
Biorobotics	バイオロボティクス特論	K. Izumi	2			○		○
Biomedical Sensing System Engineering	医工計測工学特論	A. Kimoto	2			○		○
Statistics in Biomedical Engineering	医工統計学特論		2					
Fluid Simulation in Biomedical Engineering	医工流体シミュレーション特論	T. Sumi	2			○		○
Biomedical System Control Engineering	医工システム制御特論	S. Goto	2		○		○	
Signal Analysis in Biomedical Engineering	医工信号解析特論	Y. Matsuda	2		○		○	
Medical Device Design	医療機器設計学特論	T. Hashimoto	2		○		○	
★Advanced Study in Biomedical Engineering I (Compulsory)	特別研究 I	Course Teachers	5			○		○
★Advanced Study in Biomedical Engineering II (Compulsory)	特別研究 II	Course Teachers	5		○		○	
★Advanced Study in Biomedical Engineering III (Compulsory)	特別研究 III	Course Teachers	10			○		○
★Advanced Study in Biomedical Engineering IV (Compulsory)	特別研究 IV	Course Teachers	10		○		○	

Outline of Major subjects

Biomedical Engineering Course

< Biomedical Engineering Special Lecture I > (生体医工学特別講義 I)

Course Teachers

All faculty members of Biomedical Engineering Course give lectures in their own fields on mechanical, electrical and electronic, and medical engineering.

< Biomedical Engineering Special Lecture II > (生体医工学特別講義 II)

Course Teachers

There is a possibility that special seminar, etc. will be held. The details will be notified if this lecture will be offered.

< Dynamics in Biomedical Engineering > (医工力学特論)

Prof. T. I. Khan

The content of the course includes the fundamentals of biomedical engineering dynamics related to the kinematics of joints and links. Modeling of relative motion in multi-joint system concerning to the biomedical engineering application includes to the course content as well.

< Biorobotics > (バイオロボティクス特論)

Assoc. Prof. K. Izumi

Robot dynamics and various biological methods of control, signal processing, and optimization are lectured.

< Biomedical Sensing System Engineering > (医工計測工学特論)

Prof. A. Kimoto

Imaging techniques using X-ray and electrical impedance, and biomedical measurement using electrical, ultrasonic, and optical sensors are lectured.

< Statistics in Biomedical Engineering > (医工統計学特論)

This class introduces the theory and practice of time series analysis, with an emphasis on practical skills. Having completed this course, you will be able to model and forecast a time series as well as read papers from the literature and start to do original research in time series analysis.

< Fluid Simulation in Biomedical Engineering > (医工流体シミュレーション特論)

Assoc. Prof. T. Sumi

Fundamental theory of computational fluid dynamics and its practical applications to biomedical engineering are lectured.

< Biomedical System Control Engineering > (医工システム制御特論)

Prof. S. Goto

In this class, system control, which plays an important role of biomedical engineering and welfare devices, is discussed.

< Biomedical Sensing System Engineering > (医工信号解析特論)

Assoc. Prof. Y. Matsuda

This class lectures on the signal analysis for biomedical engineering. Particularly, Kalman filter and related mathematical foundation are provided.

< Medical Device Design > (医療機器設計学特論)

Assoc. Prof. T. Hashimoto

This lecture describes the knowledge of fluid engineering required for designing medical devices related to fluid.

< Advanced Study in Biomedical Engineering I > (特別研究 I)

Course Teachers

To carry out their researches on biomedical engineering, students learn fundamental knowledge by investigating related papers, decide their research topics, and make their research plans.

< Advanced Study in Biomedical Engineering II > (特別研究 II)

Course Teachers

To establish their research methods, students carry out their researches by applying fundamental knowledge got in Advanced Study in Biomedical Engineering I. Moreover, students analyze the obtained research results to make preparation for their research presentations.

< Advanced Study in Biomedical Engineering III > (特別研究 III)

Course Teachers

Students continue their researches by themselves. Moreover, students decide the topic of their master thesis.

< Advanced Study in Biomedical Engineering IV > (特別研究 IV)

Course Teachers

Students continue to their researches by themselves. Moreover, students complete their master thesis and make master thesis defenses.

Curriculum for the students of Functional Biomolecular Science Course
 (健康機能分子科学コース授業科目)

Major Subjects				Semester				
Subjects		Teachers	Credits	25- I	25- II	26- I	26- II	27- I
Advanced Medicinal Chemistry I	分子創薬学特論I	S. Osada	1			○		○
Advanced Medicinal Chemistry II	分子創薬学特論 II	S. Osada	1			○		○
Advanced Reaction Chemistry II	反応化学特論 II	T. Fujisawa	1			○		○
Advanced Reaction Chemistry I	反応化学特論 I	T. Fujisawa	1			○		○
Advanced Biomolecular Chemistry I	生命物質化学特論 I	Y. Tokudome	1		○		○	
Advanced Biomolecular Chemistry II	生命物質化学特論 II	Y. Tokudome	1		○		○	
Advanced Bioenvironmental Chemistry I	生命環境化学特論I	T. Umeki	1		○		○	
Advanced Bioenvironmental Chemistry II	生命環境化学特論 II	T. Umeki	1		○		○	
Exercise in Functional Biomolecular Science A	健康機能分子科学演習A	Course Teachers	2			○		○
Exercise in Functional Biomolecular Science B	健康機能分子科学演習B	Course Teachers	2		○		○	
Exercise in Functional Biomolecular Science C	健康機能分子科学演習C	Course Teachers	2			○		○
Exercise in Functional Biomolecular Science D	健康機能分子科学演習D	Course Teachers	2		○		○	
Special Exercise in Functional Biomolecular Science B	健康機能分子科学特別演習B		2					
★Advanced Study in Functional Biomolecular Science I (Compulsory)	特別研究 I	Course Teachers	5			○		○
★Advanced Study in Functional Biomolecular Science II (Compulsory)	特別研究 II	Course Teachers	5		○		○	
★Advanced Study in Functional Biomolecular Science III (Compulsory)	特別研究 III	Course Teachers	10			○		○
★Advanced Study in Functional Biomolecular Science IV (Compulsory)	特別研究 IV	Course Teachers	10		○		○	

Outline of Major subjects

Functional Biomolecular Science Course

< Advanced Medicinal Chemistry I > (分子創薬学特論 I)

Prof. S. Osada

Medicinal chemistry focusing on targeting biomolecules, such as enzymes and receptors.

< Advanced Medicinal Chemistry II > (分子創薬学特論 II)

Prof. S. Osada

Medicinal chemistry focusing on designing and developing small organic molecules including pharmacokinetics.

< Advanced Reaction Chemistry I > (反応化学特論 I)

Assoc. Prof. T. Fujisawa

Comprehensive learning of biosystems, cells, and thermodynamics for biochemical processes.

< Advanced Reaction Chemistry II > (反応化学特論 II)

Assoc. Prof. T. Fujisawa

In-depth learning of biomolecules, enzymes, and theory of enzymatic reactions.

< Advanced Biomolecular Chemistry I > (生命物質化学特論 I)

Prof. Y. Tokudome

Understand the roles of substances contained in living organisms (especially skin). Learn about the physiological functions of the skin.

< Advanced Biomolecular Chemistry II > (生命物質化学特論 II)

Prof. Y. Tokudome

Understand the factors that are important for the percutaneous penetration of compounds and understand their relevance to cosmetics and pharmaceuticals.

< Advanced Bioenvironmental Chemistry I > (生命環境化学特論 I)

Assoc. Prof. T. Umeki

This class includes lectures on principles and techniques of nuclear magnetic resonance spectroscopy for the studies of protein, polysaccharide, and so on.

< Advanced Bioenvironmental Chemistry II > (生命環境化学特論 II)

Assoc. Prof. T. Umeki

This class includes lectures on principles and techniques of nuclear magnetic resonance spectroscopy for the studies of organic mercury, nitrogen oxide, and so on.

< Exercise in Functional Biomolecular Science A > (健康機能分子科学演習 A)

Course Teachers

This class includes lectures on students' own specialties for each research field such as inorganic chemistry, medical chemistry, physical chemistry, and analytical chemistry with small class.

< Exercise in Functional Biomolecular Science B > (健康機能分子科学演習 B)

Course Teachers

Research activities on students' own research topics such as references investigation, etc. are carried out.

< Exercise in Functional Biomolecular Science C > (健康機能分子科学演習 C)

Course Teachers

This class includes research activities on students' own research background with small class.

< Exercise in Functional Biomolecular Science D > (健康機能分子科学演習 D)

Course Teachers

This class includes research activities at a scientific meeting on students' own research topics.

< Special Exercise in Functional Biomolecular Science B > (健康機能分子科学特別演習 B)

This class includes research activities at an international partnership program.

< Advanced Study in Functional Biomolecular Science I > (特別研究 I)

Course Teachers

This study includes postgraduation research such as experiments, reading on research paper, and so on.

< Advanced Study in Functional Biomolecular Science II > (特別研究 II)

Course Teachers

This study includes postgraduation research such as experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study in Functional Biomolecular Science III > (特別研究 III)

Course Teachers

This study includes postgraduation research such as interim presentation, experiments, reading on research paper, writing on abstracts and so on.

< Advanced Study in Functional Biomolecular Science IV > (特別研究 IV)

Course Teachers

This study includes postgraduation research such as presentation outside the University, experiments, reading on research paper, writing on abstracts and so on.

Doctor Course

Description of the Doctor Course and Guidance of course registration

Course registration and requirements for the degree

(1) Philosophy of foundation

This special educational program for Doctor Course has been established to nurture talented engineers and researchers who are able to contribute to the development of Asian countries and the construction of an international network for advanced scientific and technological development in the fields of AI and Data science. They are expected to play globally and actively. The curriculum consists of Mathematical and Information Science Course, Mechanical and Electrical Energy Engineering Course, Architectural Design Course, and Biological and Material Engineering Course. Students are involved in one of these courses in the Department of Science and Engineering, and they study and research primarily the content related to their course. This program provides a comprehensive education for the students to acquire extensive knowledge necessary to create innovative science and technology for a sustainable and prosperous society. In order to cultivate academic knowledge and international sense, the following opportunities are provided.

- Intensive International Seminar and lecture.
- Interning study at overseas universities.
- Interning study at corporations and research institutes.
- Support for presentation and discussion at international symposium or conference.

All lectures are given in English and the thesis should be written in English. Completed students will be globally active in AI and Data science fields as engineers for technological innovation, researchers in think tanks, administrative officers, academic staff for higher education, and so on.

(2) Research Supervisor

The school selects one advisory professor and two vice-advisory professors (associate professors) for each student with reference to student's requests. In the case that research work needs collaboration with outside research agencies, outside researcher or professor can join additional member of vice-advisory staff. This advisory system enhances the research activity of students.

Students will receive this guidance and start their graduate research from their first year of doctor course. Also, the students will receive a course registration guidance by the main advisory professor.

(3) Requirements for the degree

1) Requirements for completion of the doctor's degree

- The period of course study should be normally equal to or more than three years.
- The number of credits earned should be equal to or more than 7 credits.
- Follow proper research advice and guidelines and pass final examinations and faculty evaluation of doctor thesis.

* In certain cases, those students who show superior results in their research may be able to finish the Doctor Course requirements in one year.

2) Those students who completed the Master course for one year are required to take Doctor Course at least two years.

Thus, the total period of course studies is at least three years.

3) Those students who are admitted to Doctor course without Master Degree are required that

- The period of course study should be equal to or more than three years.
- The number of credits earned should be equal to or more than 7 credits.
- Follow proper research advice and guidelines and pass the final examinations and faculty evaluation of Doctor Thesis.

* In certain cases, those students who show superior results in their research may be able to finish the Doctor Course requirements in one year.

Only those students who achieved superior results in their research are permitted to reduce the period of course study.

Exceptional results in research are as same value as results which normally students take three

years (for that results).

(4) Degree

Degree titles are as follows;

- Doctor of Philosophy in Science
- Doctor of Philosophy in Engineering

* The degree title, Science or Engineering, depends on the content of the doctoral dissertation.

The degree is conferred twice a year, on March and on September. Students are required to apply for the faculty evaluation of the thesis to the Dean of Doctor course in the Graduate school.

- Only qualified students can apply Doctoral Degree. Qualifying examination will be conducted before application.
- Degree conferred on March is required to be applied for from January 5 to 10
- and degree conferred on September is required to be applied for from June 21 to 30 both in same year.

The thesis are required as same value as thesis of international scientific journal with referee system and/or domestic (Japanese) journal of scientific society.

(5) Subjects and Credits

Doctor students are required to take 7 credits in total.

	Special Subjects	Course Major Subjects	TOTAL
Minimum of credit	6	1	7

For the purpose of attaining academic philosophy, the Doctor course opens not only the lectures for the course major subjects but also those for the special subjects.

Educational Affairs Office inform the date and time of lecture through bulletin board; however, students are required to keep in touch with their supervisors.

1) Special subjects (compulsory)

- Special PBL on AI • DS with 2 credits.

The lecture is opened under the purpose to develop students not only to become specialist but also to have interest in extensive field and knowledge, flexibility, and synthetic consideration. Theme will be announced at the beginning of semester when the class is offered.

- Synthetic Seminar on AI • DS with 2 credits

For the purpose of self-enlightenment and becoming academically synthetic, students are required to report their research and discuss with professors and other students. One seminar group is organized with approximately five students and some academic staff.

- Intensive International Seminar for Interning Study with 2 credits

In principle, each student must participate in an international partnership held in Saga University or in a country other than the student's nationality. Instead of an international partnership, each student may participate in an intensive seminar or a summer school which is performed in English in a country other than the student's nationality.

2) Special subjects (elective/optional)

- Practical Cooperative Project with 2 credits

The purpose of this project is to participate in project research conducted by faculty members of the Graduate School of Science and Engineering, to deepen exchanges with researchers and engineers outside the university, and to nurture knowledge as a professional. For example, students may participate in joint research and projects with companies, research institutes, and CIREn (Co-creative Innovation platform for Renewable Energy) related to the student's specialty. Credits of this subject can be included in the number of credits of Course Major Subjects among the number of Requirements for completions credits.

- Overseas Interning Study with 2 credits.

For the purpose of accelerating or expanding research work, research collaboration and lectures at overseas universities or institutes through academic exchange agreement are also prepared. In general, the active term is from 3 months to half a year. Achievements and credits will be considered for recognition.

- Regional Collaborative Career Workshop with 2 credits.

The aim of the workshop is to assist international students to form the cultural and societal basis for their activities in job hunting in Japan and to some extent working for Japanese

companies, including their future internships in Japanese companies. The workshop is provided in collaboration with companies in Saga prefecture and the Saga prefectural government. The workshop is held as a year-round subject, starting in the autumn semester. The credits (two) of the workshop are not counted to satisfy any partial requirement to obtain an academic degree in IEPAD.

- Regional Collaborative Internship with 1 credits.

This internship course aims to assist international students who seriously want to work in Japan in the future to understand the working environment and working in Japanese companies or organizations through practical work experience that utilizes general skills including their characteristics of being international students. This work-based internship is provided in collaboration with companies in Saga prefecture and the Saga prefectural government. This internship course is a year-round course in which a one-week internship is held during the summer break after prior orientation and guidance. To take this course, you should be a student who has taken or is currently taking the "Regional Collaborative Career Workshop, which requires students to have proficiency of Japanese for communication with people in companies, for example." The credit (one) of this internship course is not counted to satisfy any partial requirement to obtain an academic degree in IEPAD.

3) Course Major Subjects with 1 credit

Advanced lectures in the specific field are given by each specific professor.

(6) Registration of classes

Students are required to submit registration notices to Registrar Section for the Graduate School in Student Center at the starting of the new semester. Registration notices are available at Registrar Section for the Graduate School in Student Center. Students are also required to register the lectures through the internet "Live Campus". Students earn credits by attending classes, passing regular examinations and/or submitting reports.

(7) Graduate lectures at other universities

When Saga University admits that some lectures are beneficial, students can attend the lectures at overseas universities and research institutes.

These lectures are carried out based on universities mutual agreement. Rules are settled in another part. Students are strongly recommended to take the lectures at overseas universities. If students will get credits, these credits will be certified as Overseas Interning Study with 2 credits.

理工学研究科博士後期課程 AI・データサイエンス高度人材の領域横断的育成プログラムにおける履修方法及び修了要件について

(1) プログラムの概要・目的について

本教育プログラムは、アジア諸国の発展と先端的科学技術開発の国際的ネットワーク構築に貢献できるグローバル人材の育成を目指して開設した大学院博士後期課程のプログラムである。カリキュラムは数理・情報サイエンスコース、機械・電気エネルギー工学コース、社会基盤・建築デザインコース、バイオ・マテリアルエンジニアリングコースで構成されている。学生は理工学専攻内に設置されたこれらの4つのコースの何れかに所属し、コースに係る内容を中心に学び研究する。このプログラムでは、持続可能で豊かな社会へとシフトしてゆくために必要なAIやデータサイエンスに関する科学技術のイノベーション創出のための知識を学ぶとともに実践力を身につける。専門知識をさらに深め国際感覚を涵養するために、次のような機会を設けている。

- ・集中講義形式で開催する国際セミナーや国際共同講義
- ・国外の協定校での中長期研修
- ・国内企業や研究機関での研修
- ・国際会議や国際シンポジウムでの講演や討論へ参加奨励と支援

講義はすべて英語で行われ、博士論文も英語での執筆となる。修了者はAIやデータサイエンス分野の国際的企業でイノベーション技術者、シンクタンク研究員、行政官、高等教育者等として活躍することが期待される。

(2) 指導教員について

学生の希望する研究課題に応じて、学生の所属するコースの博士後期課程主指導担当教員の中から1名の主指導教員を選任し、これに2名の副指導教員を加えることによって指導体制を組織する。副指導教員については、他のコースの教員（本研究科博士後期課程担当教員に限る。）を選ぶこともできる。また、共同研究を行う国内外の大学教員／研究機関研究員を副指導教員として加えることができる。学生は1年次から研究指導を受ける。また、履修指導を主指導教員から受ける。

(3) 修了要件について

- 1) 博士前期（修士）課程に2年間以上在学して前期課程を修了した者については、標準で3年以上後期課程に在学し、後期課程所定の7単位を履修し、必要な研究指導を受け、博士論文の審査に合格し、最終試験に合格しなければならない。ただし、優秀な研究業績をあげた者は、1年以上在学すればよい。
- 2) 前期（修士）課程を1年で修了した場合には、優秀な研究業績をあげた者でも、後期課程には2年以上在学しなければならない。つまり、前後期あわせて最短でも3年以上の在学期間が必要ということになる。
- 3) 大学院において修士の学位を有する者と同等以上の学力があると認められて、後期課程に入学した者については、1)と同様、標準で3年以上在学し、後期課程所定の7単位を履修し、必要

な研究指導を受け、学位論文審査と最終試験に合格しなければならない。ただし、優秀な研究業績をあげた者は、1年以上在学すればよい。

(4) 学位について

学位の種類は、博士（工学）、博士（理学）である。現状では、博士（工学）、博士（理学）は研究の内容によるとしている。

学位の授与は、年2回（3月と9月）行う。博士論文の審査を申請するには、指導教員との十分な打ち合わせの後、学位申請資格認定（博士論文の内容が申請するに足る資格を有するか否かの認定）を受けなければならない。

学位申請資格認定を受けた者は、次の期間内に学位申請書を教務課に提出すること。

○3月に学位の授与を受けようとする者 同年の1月5日から1月10日まで

○9月に学位の授与を受けようとする者 同年の6月21日から6月30日まで

博士論文は、審査制度のある国際的学術雑誌若しくは国内外の学会誌等に掲載される水準であることが要求される。

(5) 授業科目及び単位について

博士後期課程の学生は、下記により7単位以上を修得しなければならない。

	プログラム共通科目	コース専門科目	合計
必要単位数	6	1	7

本研究科の教育理念を実現するために、コース専門科目のほかに、AI・DS 特別PBL、AI・DS 総合セミナー、国際インターン研修、実践的協働プロジェクト、長期インターン研修、地域連携キャリア研修、地域連携インターンシップが開講される。学生はコース専門科目から1単位、AI・DS 特別PBL（2単位）、AI・DS 総合セミナー（2単位）および国際インターン研修（2単位）の合計7単位を履修しなければならない。

1) プログラム共通科目（必修）

・AI・DS 特別PBL（2単位）必修

AI やデータサイエンス分野の諸問題を中心に、専門能力とともに幅広い領域に関する関心や知識、柔軟な適応能力、総合的思考能力を育てるための教育を行う。専門分野および周辺または異分野の教員が協働して実施する。

・AI・DS 総合セミナー（2単位）必修

受講生が本人の研究分野を中心に発表・討議を行い、自己啓発力および学際的総合能力を養う。セミナーの1グループは5名程度の学生と専門分野と周辺分野の教員数名程度で構成される。

・国際インターン研修（2単位）必修

国際インターン研修（必修）は、本学が学生の国籍以外の国で開催する国際パートナーシップへの参加を原則とするが、学生の国籍以外の国で英語で行われる短期集中セミナー、サマースクールも認める。

2) プログラム共通科目（選択）

・実践的協働プロジェクト（2単位）

理工学研究科の教員が実施しているプロジェクト研究に参加し、学外の研究者や技術者との交流を深め、専門的職業人としての素養を養う。学生の専門に関連のある企業、研究所やCIREn (Co-creative Innovation platform for Renewable Energy=「再生可能エネルギー等イノベーション共創プラットフォーム」)等との共同研究やプロジェクト等に参加してもよい。本科目の単位は、修了要件単位数のうちのコース専門科目の単位数に含めることができる。

・長期インターン研修（2単位）

受講生が関与する研究分野において、研究の質を高めることと進捗展開を促すことを目的として長期（3ヶ月から6ヶ月程度）に渡り国外の交流協定校で共同研究に参加する。業績等については、長期インターン研修（2単位）として認定する。長期インターン研修（2単位）を修得した場合は、国際インターン研修（2単位）の修得を不要とする。

期間中に講義単位を修得した場合は、講義時間数、内容等を審議の上、コース専門科目を履修したものとして認定する。

・地域連携キャリア研修（2単位）

本研修の目的は、将来の就職活動、インターンシップを含めた日本での就労に資する留学生の文化的、社会的基盤の形成を支援することである。佐賀県及び県内の企業と協働して実施される研修である。研修は秋学期に開始し、通年科目として実施される。IEPADの修了要件には含まれない。

・地域連携インターンシップ（1単位）

将来、日本での就労を真剣に望む留学生に、留学生である特性も活かす実践的な汎用的能力活用型の業務体験によって日本の企業や組織における労働環境や就労の理解を支援することを目的とする。佐賀県および県内の企業と協働して実施される業務遂行型インターンシップである。事前のオリエンテーションならびにガイダンスを実施後に、夏期休業期間中にインターンシップ（8時間×5日間）が実施される通年科目である。本履修においては、「地域連携キャリア研修」（日本語能力でのコミュニケーション力が必須）を履修した学生もしくは履修中の学生であることが必要である。IEPADの修了要件には含まれない。

3) コース専門科目（1単位）選択必修

各コース教員が行う高度の専門的内容を持つ科目である。必ず所属コースのコース専門科目1単位を修得しなければならない。

(6) 履修手続きについて

授業科目を履修し、単位を取得するためには、次の手続きを経なければならない。

履修登録は、履修手続期間内に教務課理工学研究科教務担当窓口又は、WEBより行うこと。

講義に出席し、定期試験を受験し、あるいは、レポート等を提出して合格点に達すれば、所定の単位が与えられる。

(7) 他の大学院等で研究指導、講義を受けることについて

教育上有益と認めれば、他の大学院、研究所（外国の大学院、研究所を含む。）で、特定の課題につき、研究指導を受けたり、講義を受講したりすることができる。これは、大学院間の協議に基づいて実施される。実施についての規則は別に定められる。

Outline of subjects

Course of Mathematical and Information Science

<Advanced Mathematical and Information Science> (数理・情報サイエンス特論)

In this course, the faculty members will lecture advanced expertise and skills in mathematics, information science, information engineering, and data science in the omnibus style. The purpose of this course is to get in touch with the specialized knowledge of the peripheral fields of mathematical and information science. The goal of this course is to acquire the essential qualifications for your doctoral research.

Course of Mechanical and Electrical Energy Engineering

<Advanced Mechanical and Electrical Energy Engineering> (機械・電気エネルギー工学特論)

Advanced specialized knowledge and technology in the fields of mechanical engineering, electrical and electronic engineering related to industrial technologies ranging from energy creation to energy utilization, including energy conversion, transportation, and storage will be lectured in omnibus form.

Course of Civil Engineering and Architectural Design

<Advanced Lecture on Civil Engineering and Architectural Design> (社会基盤建築デザイン特論)

Conditions for a comfortable and safe living environment, and the highly specialized knowledge of the environment creation and global examples will be lectured in omnibus form.

Course of Biological and Material Engineering

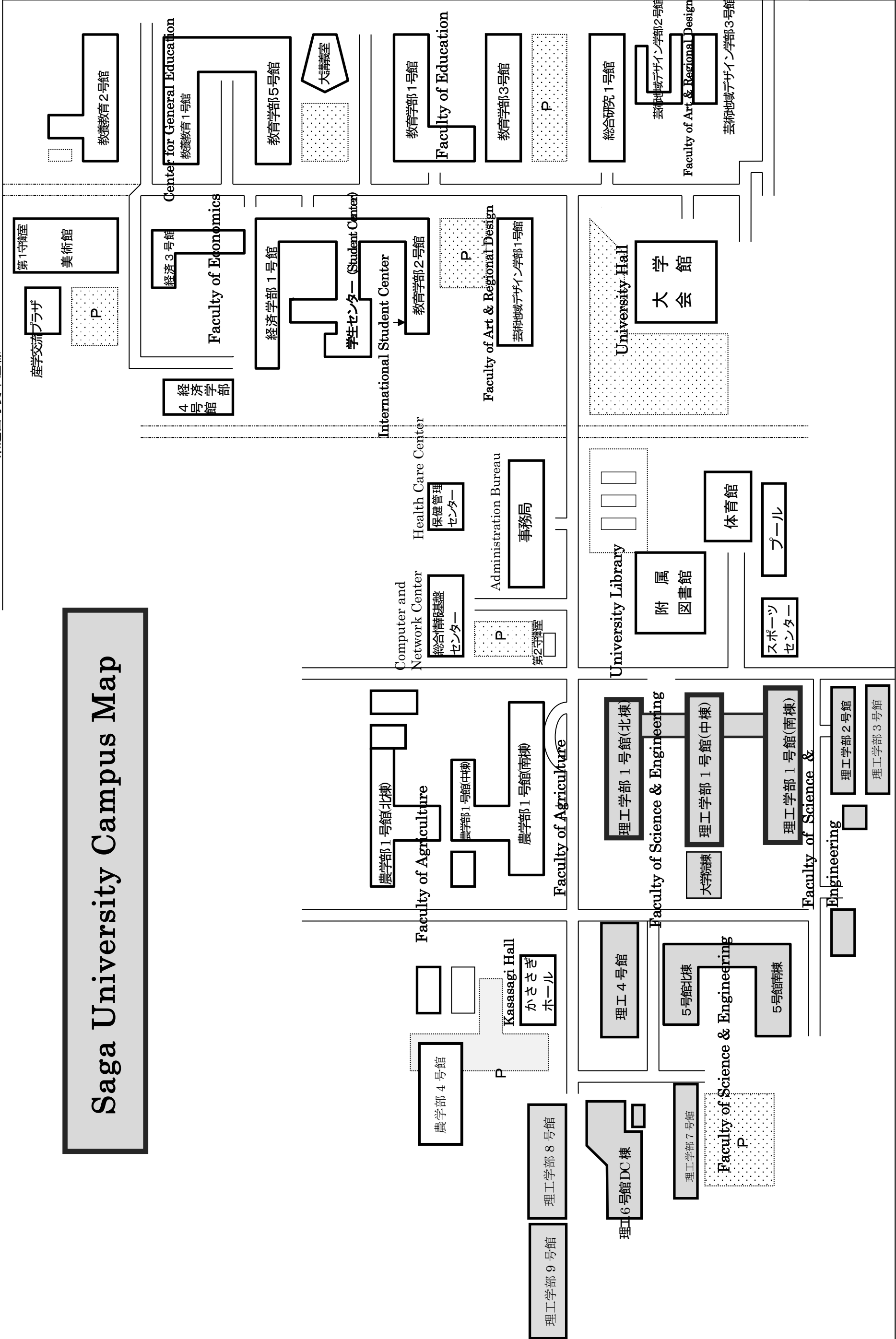
<Advanced Biomaterial Systems> (生体物質システム学特論)

Based on materials science, materials engineering, electrical engineering, and mechanics, advanced and specialized knowledge and techniques of functional materials, such as bio-, optical, and electrical/magnetic-related materials and nanomaterials, or the interaction between organisms and systems will be lectured in omnibus form.

Saga University Campus Map

正 門
Main Entrance

県道西与賀本庄線



国道 208 号 Route 208