Saga University

Education Program for AI and Data science specialists (EPAD)

Subject Guide

2024 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 ---- 8

Curriculum for the students of Data Science Course ---- 11

Outline of Major Subjects ---- 12

Curriculum for the students of Computer Science and Information Technology Course ---- 15

Outline of Major Subjects ---- 16

Curriculum for the students of Energy and Mechanical Engineering Course ---- 18

Outline of Major Subjects ---- 19

Curriculum for the students of Mechanical Systems Engineering Course ---- 21

Outline of Major Subjects ---- 22

Curriculum for the students of Electrical and Electronic Engineering ---- 24

Outline of Major Subjects ---- 25

Curriculum for the students of Biomedical Engineering Course ---- 27

Outline of Major Subjects ---- 28

Description of the Doctor Course and Guidance of course registration ---- 30

Course registration and requirements for the degree

［ Outline of Subject ］

Course of Mathematical and Information Science ---- 37

Course of Mechanical and Electrical Energy Engineering ---- 37

Course of Biological and Material Engineering ---- 37

Saga University Campus Map

ACADEMIC CALENDAR

SPRING SEMESTER

April 1, 2024	Spring Semester begins.
April 2, 2024	Entrance Ceremony (for Spring Enrollment Students)
April 3-8, 2024	Orientation (for Spring Enrollment Students)
April 9, 2024	Classes start.
July 29, 2024	Spring Semester Examination (until August 2)
August 6, 2024	Summer Vacation (until September 30)
September 30, 2024	End of the Spring Semester

AUTUMN SEMESTER

October 1, 2024	Autumn Semester begins.
October 1, 2024	Classes start.
October 4, 2024	Entrance Ceremony (for Autumn Enrollment Students)
December 25, 2024	Winter Vacation (until January 7)
February 5, 2025	Autumn Semester Examination (until February 12)
March 31, 2025	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 provide talented engineers and researchers who are able to contribute Asian development and to achieve higher technological renovation in the fields of AI and Data science through masters courses education. They are expected to play globally and actively as well. The curriculum consists of Data Science Course, Computer Science and Information Technology Course, Energy and Mechanical Engineering Course, Mechanical Systems Engineering Course, Electrical and Electronic Engineering Course, Biomedical Engineering 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 with Japanese and foreign students. Opportunities to train and achieve actual communicating experience at overseas are also provided. All lectures are given in English and 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 of final examinations and faculty evaluation of masters thesis.
- In certain cases, those students who show superior results they may be able to finish the masters 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 put it forward. His/her course will organize 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 Corporate Interning Study (elective/optional): It is technological interning study at corporation and research institute. Credits of this subject can be included in the number of credits of Major Subjects.

Students need to talk with his/her main advisory professor and Registrar Section for the Graduate School in Student Center 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 huntings 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 EPAD.

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 EPAD.

- Student should earn at least 4credits on Core subjects of Data Science Course or Computer Science and Information Technology Course. In addition, student belongs to Graduate School of Advanced Health Science should earn at least 4credits on Core subjects of the Department that he/she belongs.
- 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 course 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，生体医工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。
・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。
・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。
・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企業インターン研修（選択）は，国内の企業もしくは研究機関での技術研修である。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。希望者は事前に指導教員と教務課に相談すること。

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。EPAD 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。EPAD 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，他コースの科目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。

他コースの授業科目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
（ﾌﾟﾛｸﾞﾗﾑ共通科目）

Course	Subjects		Teachers	Credits	Semester				
					24- I	24- II	25- I	25- II	26- 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				
	Corporate Interning Study	企業インターン研修		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				
					24- I	24- II	25- I	25- II	26- I
Data Science Course	(A) Advanced Mathematical Structure for Information Science	情報数理構造特論	M. Hirotomo	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	S. Tadaki	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		○		○	
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		○		○	

Outline of Core Subjects

Data Science Course

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

Assoc. Prof. M. Hirotomo

This lecture introduces cryptograph and algebra. The main topics are mathematical structure and algebric 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. Hieida

Birth-death processes are used as models of natural and social phenomena. This lecture treats how to simulate a birth-death process from the basics which contain mathematical background. The ability to write Python programs and prior knowledge of probability (for example, the variance of the binomial distribution) are assumed.

< 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)

Prof. S. Tadaki

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.

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.

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.

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	24- Ⅰ	24- Ⅱ	25- Ⅰ	25- Ⅱ	26- 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) PBL on Cyber Physical System	サイバーフィジカルシステム開発PBL	O. Fukuda	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, Hirotomo	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, Hirotomo, Kimura, Hibino, Handa, Okumura, Hanada, Kakeshita, Yamaguchi, Matsumae, Nakayama, Fukuda, Kinoshita, Hori, Otani	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)

Assoc. Prof. K. Nakayama

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

< PBL on Cyber Physical System > (サイバーフィジカルシステム開発 PBL)

Prof. O. Fukuda

In this Problem-Based Learning (PBL) class, we will discuss how to solve real-world problems based on cyber-physical system. The student groups aim to solve problems with under the supervisor's support.

< 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. 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.

< 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	24- I	24- II	25- I	25- II	26- 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	○		○		○
PBL on Cyber Physical System	サイバーフィジカルシステム開発PBL	O. Fukuda	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		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, Tadaki, Minamoto,Kakeshita, Matsumae, Okazaki, Hieida, Nakayama, Otani, Ohtsuki, Kimura, Hirotomo, Yamaguchi, Hori	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)

Assoc. Prof. K. Nakayama

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

< PBL on Cyber Physical System > (サイバーフィジカルシステム開発 PBL)

Prof. O. Fukuda

In this Problem-Based Learning (PBL) class, we will discuss how to solve real-world problems based on cyber-physical system technique. The student groups actively aim to solve problems with under the supervisor's support.

< 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)

Prof. S. Tadaki

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. E. Hanada 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 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	24- Ⅰ	24- Ⅱ	25- Ⅰ	25- Ⅱ	26- 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	T. Murakami	2		○		○	
Advanced Ocean Engineering	海洋工学特論	T. Yasunaga	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,Imai,Kariya,Shiomi,Murakami,Yoshida	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)

Assoc. Prof. T. Murakami

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

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

Assoc. Prof. T. Yasunaga

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. A. Miyara 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. A. Miyara 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. A. Miyara 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. A. Miyara 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	24- Ⅰ	24-Ⅱ	25- Ⅰ	25-Ⅱ	26- 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	B. Zhang	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,Zhang,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)

Prof. B. Zhang

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)

Assoc. 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. N. Hattori 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. N. Hattori 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. N. Hattori 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. N. Hattori 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	24- Ⅰ	24- Ⅱ	25- Ⅰ	25- Ⅱ	26- Ⅰ
Advanced Information Electronics on Materials	物質情報エレクトロニクス特論		2					
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	S. Sasaki	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	○		○		○
Graphical User Interface	グラフィカル・ユーザ・インターフェース特論		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,Sasaki,Tanaka,Itoh,Fukumoto,Nishiyama,Takahashi,Saito, Misawa	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 Information Electronics on Materials > (物質情報エレクトロニクス特論)

In the electronics field, the knowledge about quantum theory becomes more and more important in order to understand the electron behavior from a microscopic standpoint. Namely, the knowledge about quantum theory is required in order to understand not only the electrical and optical properties of semiconductor but also the principles of new electronic and optical devices. The fundamental and systematical knowledge about quantum theory is given in this subject.

< 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)

Assoc. Prof. S. Sasaki

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.

< Graphical User Interface > (グラフィカル・ユーザ・インターフェース特論)

First we will learn the fundamental programming for GUI using Xt Intrinsics in X Window System to grasp the concept of the Toolkit programming. After learning Xt Intrinsics, we will use another GUI Toolkits such as Gtk+ and Qt to implement advanced applications with better user interface.

< 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. Y. Ohtsu etc.

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

Prof. Y. Ohtsu etc.

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

Prof. Y. Ohtsu etc.

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

Prof. Y. Ohtsu etc.

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	24- Ⅰ	24- Ⅱ	25- Ⅰ	25- Ⅱ	26- 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	K. Teramoto	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 engineerings.

< 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)

Assoc. 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)

Assoc. 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)

Prof. K. Teramoto

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.

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 produce talented engineers and researchers who are able to contribute to Asian development and to achieve higher technological innovation 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, Biological and Material Engineering Course. Students are involved in one of these courses in the Department of Science and Engineering, and doing study and research related to any groups for major field. 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 oversea 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 thesis should be written in English. Completed students will be globally active in AI and Data science fields as engineer for technological innovation, researcher in think tank, administrative officer, and academic staff for higher education and so on.

(2) Research Supervisor

The school selects one advisory professor and two vice-advisory professors (associate professor) 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 are at least three years.

3) Those students who admitted to enroll Doctor course without Master Degree and 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 reduced 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 apply from January 5 to 10
- and degree conferred on September is required to apply 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 (Japan) 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 ideology, the Doctor course opens not only the lectures for major subjects but also the special subjects for compulsory. Credits of Special Subjects are 2 and credits of Course Major Subjects are 1.

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 Lecture on AI・DS with 2 credits in each.

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 academically synthetic, students are required to report their research and discuss with professors and other students. One seminar group is organized approximately five students and some academic staffs.

・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)

・Corporate Interning Study with 2 credits

Students develop and cultivate their research ability and approaching a problem at active site such as corporation or institute through special experiments relating with AI and Data science fields. It is aimed at developing student’s discussion ability, collecting information and analyzing materials concerning one's research field and also to master the methodology out of his/her major fields. Report from host-corporation or institute and student will be considered for recognition. Credits of this subject can be included in the number of credits of Major Subjects among the number of Requirements for completions credits. Students need to talk with his/her main advisory professor and Registrar Section for the Graduate School in Student Center in advance.

・Overseas Interning Study with 2 credits.

For the purpose of accelerating or expanding research work, research collaboration and lecture at overseas universities or institutes through academic exchange agreement are also prepared. In general, active term is from 3 months to half a year. An 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 EPAD.

・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 EPAD.

3) Course Major Subjects with1 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 institute.

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，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 3 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。

〇3 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

〇9 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 特別講義，AI・DS 総合セミナー，国際インターン研修，企業インターン研修，長期インターン研修，地域連携キャリア研修が開講される。学生はコース専門科目から 1 単位，AI・DS 特別講義（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 特別講義（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）

・企業インターン研修（2 単位）

AI やデータサイエンス分野におけるイノベーション技術の実用化の現場である企業の技術セクションあるいは研究機関で，中期間のインターン研修を行うことで研究開発の取組みの実際を見聞，実習し研究能力の啓発と多様な切り口についての研鑽を行う。受入れ機関と受講者の研修レポートにより単位を認定する。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。希望者は事前に指導教員と教務課に相談すること。

・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 ケ月から 6 ケ月程度）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。EPAD 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。EPAD 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 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