Saga University

Education Program of Advanced T-shaped Person for Co-development of ASEAN and Japan (EPAT)

Subject Guide

2023 Enrollment Students

Master Course

Science and Engineering
Advanced Health Science

Doctor Course

Science and Engineering

Contents

ACADEMIC CALENDAR

AUTUMN SEMESTER

October 1, 2023	Autumn Semester begins.
October 2, 2023	Classes start.
October 4, 2023	Entrance Ceremony (for Autumn Enrollment Students)
December 23, 2023	Winter Vacation (until January 7)
February 7, 2024	Autumn Semester Examination (until February 14)
March 31, 2024	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

The Education Program of Advanced T-shaped Person for Co-development of ASEAN and Japan (EPAT) provides all lectures, seminars, and internships, etc. on global environmental, energy problems and health expertise in English for both foreign and Japanese students. Environmental, energy and resource problems associated with rapid economic development are particularly serious in Asian countries, many of which are developing countries. For the sound development of developing countries, it is necessary to fully understand and analyze the challenges that Asian countries face, and to develop comprehensive technologies that also include management. EPAT will be established in the Graduate School of Science and Engineering and the Graduate School of Advanced Health Sciences in order to nurture “T-shaped advanced human resources” who have a corporate perspective and AI data science besides a deep specialized research and development capabilities. We aim to develop human resources who can demonstrate leadership in research and development related to the environment, equipped with specialized knowledge of science and engineering and medical engineering, a business perspective, and knowledge of AI and data science. We will contribute to the common development of ASEAN and Japan in order to solve energy and resource issues.

(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, Integration Seminar on Sci・Eng and Intensive International seminar for Interning and all are compulsory.

・ More than 42 credits from Major Subjects, including Advanced studies I ~ IV of courses.

①Collaborating PBL: Students deal with problems or projects concerning environmental or energy or health science field as task under collaborating with Japanese students and foreign students. Appropriate adviser will guide them considering the issue.

②Integration Seminar on Sci・Eng: 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 organizes.

③Intensive International Seminar for Interning Study: 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.

④Practical Cooperative Project: 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): 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 EPAT. (The workshop is the PhD counterpart of the workshop with the identical name for MA students provided by Center for Promotion of International Interactions of Saga University in Organization for General Education.)

- Student should earn at least 4credits on Core subjects of the Course Group that he/she belongs.
- Credits of Core Subjects exceeding 12 credits can be transferred to the Major subjects.
- 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 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 ASEAN と日本の共発展を目指す T 型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

成長が著しい ASEAN 諸国においては，急速な経済発展に伴う環境・エネルギー・資源問題が深刻である。成長国の健全な発展のために，ASEAN 諸国がそれぞれに抱える課題を十分に把握・分析した上で，なおかつマネジメントも含む総合的な技術開発が求められている。本教育プログラムは，深い専門的研究開発能力の縦軸と，企業的視野と AI・データサイエンスを両翼にもつ「T 字型の高度人材」の育成を目的として，理工学研究科および先進健康科学研究科の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において教育と研究指導が行われる。プログラムは，外国人留学生と日本人学生が共学し，環境，エネルギー及び健康科学の専門知識に関する講義，セミナー，およびインターンシップ研修などの教育カリキュラムを全て英語で実施する。本プログラム修了後には，理工学系分野及び医工学系分野の専門的知識と企業的視野，AI・データサイエンスの知識を持ち，環境・エネルギー・資源問題について研究開発やリーダーシップを発揮できる人材として，ASEAN と日本の共発展に貢献していくことが期待される。

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，60 単位以上を修得し，かつ，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することとする。ただし，在学期間については，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
必要単位数及び条件	共学 PBL(2 単位)，理工統合セミナー (2 単位)，国際インターン研修(2 単位)を必修とする。	12 単位以上 ※自コース群（Course Group）から 4 単位以上	各コースの特別研究Ⅰ～Ⅳを含め，専門科目から 42 単位以上　※日本人学生は，学術英語特論を必修とし，上記 42 単位に含めるものとする。

＊プログラム共通科目について

・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。

・理工統合セミナー（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。

・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。

・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。

・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。EPAT の修了要件には含まれない。（佐賀大学国際交流推進センターによって全学教育機構において提供される同名の修士課程の科目の EPAT 版である）。

＊コア科目については，所属するコース群（Course Group）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。

＊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。

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				
					23- I	23- II	24- I	24- II	25- I
All Courses	★Collaborating PBL(Compulsory)	共学PBL	TBD	2		○			
	★Integration Seminar on Sci・Eng(Compulsory)	理工統合セミナー		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		○		○	

Core Subjects
（専門選択必修科目）

Course Group	Course	Subjects		Teachers	Credits	Semester				
						23-I	23-II	24-I	24-II	25-I
Environment System Course Group	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			○		○
	Civil Engineering Course	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 Geo-sphere Environmental Engineering in Lowland	低平地地圏環境学特論	T. Hino	2			○		○
	Architectural Design Course	Urban Development and Urban Systems	都市構成システム論	T. Inohae	2		○		○	
		Advanced Environmental Engineering of Architecture	建築環境工学特論	S. Kojima	2					○
Energy System Course Group	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 Engineering	流体工学特論	S. Matsuo	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 Dynamics of Machinery	機械力学特論	T. Tsujimura	2		○			
		Advanced Precision Machine	精密機器工学特論	B. Zhang	2			○		
		Advanced Mechanics of Materials	材料力学特論	N. Hattori	2			○		○
	Electrical and Electronic Engineering Course	Advanced Semiconductor Device Engineering	半導体デバイス工学特論	M. Kasu	2		○		○	
		Advanced Pulsed Power Engineering	パルスパワー工学特論	S. Ihara	2		○		○	
		Advanced Processing Plasma Engineering	プロセスプラズマ工学特論	Y. Ohtsu	2			○		○
		Advanced New & Saved Energy Engineering	新・省エネルギー工学特論	E.Nishiyama	2		○		○	
Health Science System Course Group	Biomedical Engineering Course	Dynamics in Biomedical Engineering	医工力学特論	T. I. Khan	2			○		○
		Statistics in Biomedical Engineering	医工統計学特論	K. Teramoto	2			○		○
		Numerical Analysis in Biomedical Engineering	医工数値解析特論	K. Muramatsu	2			○		○
		Biomedical System Control Engineering	医工システム制御特論	S. Goto	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

環境系コース群 <Environment System Course Group>
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.

Civil Engineering Course

<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 ara as follows: 1) behavior and strength of soils, 2) laboratory testing and engineering properties of soils, 3) ground improvement technologies.

<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.

Architectural Design Course

<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 research 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.

<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.

エネルギー系コース群 <Energy System Course Group>
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 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 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 Dynamics of Machinery > (機械力学特論)

Prof. T. Tsujimura

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

< 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 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.

Electrical and Electronic Engineering Course

< 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.

<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 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 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.

健康科学系コース群 <Health Science System Course Group>
Biomedical Engineering Course

< 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.

< 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.

< 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.

< 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.

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 introduces.

< 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 ransition, 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 ransition, 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 Advanced Materials Chemistry Course

（機能材料化学コース授業科目）

Major Subjects				Semester				
Subjects		Teachers	Credits	23- Ⅰ	23- Ⅱ	24- Ⅰ	24- Ⅱ	25- Ⅰ
Fundamental Material Chemistry	機能材料化学基礎特論	Ohto,Takeshita,Tominaga,Hanamoto,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	T. Hanamoto	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,Hanamoto,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 ChemistryⅢ (Compulsory)	機能材料化学特別研究Ⅲ	same as above	10		○		○	
★Advanced Study in Applied Material ChemistryⅣ (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)

Prof. T. Hanamoto

A course mainly deals with highly-stereoselective organic reaction (chemoselectivty, 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. M. Takeshita 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. M. Takeshita 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. M. Takeshita et al.

This study includes postgraduation research such as interrim 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. M. Takeshita 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	23- I	23- II	24- I	24- II	25- I
Advanced Thermodynamics	熱力学特論	K. Ishida	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 Thermodynamics > (熱力学特論)

Lect. K. Ishida

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

< 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

1) Sea Environment
2) Numerical Method for Load and Response of Structure
3) Design of Offshore Structure

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

Prof. S. Yoshida

1) Theory of Sea Waves
2) Hydro Dynamics of Offshore Structures
3) Conversion of Ocean Energy

< 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	23- Ⅰ	23-Ⅱ	24- Ⅰ	24-Ⅱ	25- Ⅰ
Advanced Thermodynamics	熱力学特論	K. Ishida	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 Lubrication Engineering	潤滑工学特論	T. Mawatari	2		○		○	
Advanced Robotics	ロボット工学特論	K .Sato	2		○		○	
Advanced Applied Dynamics	応用力学特論	T. Tsujimura	2		○			
Advanced Manufacturing Processes	生産加工学特論	F. Ohshima	2		○		○	
Advanced Surface Engineering	表面工学特論	H. Hasegawa	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 Computational Mechanics	計算力学特論	Y. Tadano	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,Tsujimura,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 Thermodynamics > (熱力学特論)

Lect. K. Ishida

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

< 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 Lubrication Engineering > (潤滑工学特論)

Assoc. Prof. T. Mawatari

1) Principle of Lubrication
2) Lubricaton Regimes
3) Mechanisms of Fluid Lbrication

<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 Applied Dynamics > (応用力学特論)

Prof. T. Tsujimura

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. Oshima

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

< 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 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 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

<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	23- Ⅰ	23- Ⅱ	24- Ⅰ	24- Ⅱ	25- 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			○		○
Advanced Wireless Communication Systems	ワイヤレス通信システム特論	I. Toyoda	2			○		○
Microwave Integrated Circuits	マイクロ波集積回路特論	T. Oishi	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 Adaptive Systems Theory	適応システム特論	H. Itoh	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 Hardware Interface Engineering	ハードウェア・インターフェース工学特論	H. Fukumoto	2		○		○	
★Advanced Study in Electrical and Electronic Engineering Ⅰ (Compulsory)	電気電子工学特別研究Ⅰ	Toyoda,Kasu,Oishi,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 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

<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

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

Prof. T. Oishi

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 micorwave 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 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.

< 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 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.

< 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 Civil Engineering Course

（都市基盤工学コース授業科目）

Major Subjects				Semester				
Subjects		Teachers	Credits	23- Ⅰ	23- Ⅱ	24- Ⅰ	24- Ⅱ	25- Ⅰ
Water Environmental System Engineering	水環境システム工学特論	V. Narumol	2			○		○
Advanced Applied Fluid Mechanics	応用流体力学特論	H. Oshikawa	2		○		○	
Advanced Structural Engineering	構造工学特論	H. Obiya	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 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 Study in Civil Engineering I (Compulsory)	都市基盤工学特別研究Ⅰ	Ohgushi,Itoh,Hino,Mishima,Obiya,Kojima,Yamanishi,Oshikawa,Narumol,Goto,Li,Inohae,Nakaohkubo,Miyahara,Negami,Mishima	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

<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 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)

Prof. H. Obiya

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.

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

Prof. T. Hino 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	23- Ⅰ	23-Ⅱ	24- Ⅰ	24-Ⅱ	25- 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 M. Miyahara	3		○		○	
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	C. 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 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	H. Obiya	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,Mishima,Obiya,Kojima,Yamanishi,Oshikawa,Narumol,Goto,Li,Inohae,Nakaohkubo,Miyahara,Negami,Mishima	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, Assoc. Prof. M. Miyahara

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.

< 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. Nakaokubo

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 panning.

< 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)

Prof. H. Obiya

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

Prof. H. Obiya 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	23- Ⅰ	23- Ⅱ	24- Ⅰ	24- Ⅱ	25- 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		○	○	○	○
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			○		○
Fluid Simulation in Biomedical Engineering	医工流体シミュレーション特論	T.Sumi	2			○		○
Medical Device Design	医療機器設計学特論	T.Hashimoto	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		○		○	
★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.

< 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.

< 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.

<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.

< 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.

< 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	23- Ⅰ	23- Ⅱ	24- Ⅰ	24- Ⅱ	25- 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 Ⅰ	反応化学特論Ⅰ	T. Fujisawa	1			○		○
Advanced Reaction Chemistry Ⅱ	反応化学特論Ⅱ	T. Fujisawa	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 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 interrim 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
The Education Program of Advanced T-shaped Person for Co-development of ASEAN and Japan (EPAT) provides all lectures, seminars, and internships, etc. on global environmental, energy problems and health expertise in English for both foreign and Japanese students. Environmental, energy and resource problems associated with rapid economic development are particularly serious in Asian countries, many of which are developing countries. For the sound development of developing countries, it is necessary to fully understand and analyze the challenges that Asian countries face, and to develop comprehensive technologies that also include management. EPAT will be established in the Graduate School of Science and Engineering and the Graduate School of Advanced Health Sciences in order to nurture "T-shaped advanced human resources" who have a corporate perspective and AI data science besides a deep specialized research and development capabilities. We aim to develop human resources who can demonstrate leadership in research and development related to the environment, equipped with specialized knowledge of science and engineering and medical engineering, a business perspective, and knowledge of AI and data science. We will contribute to the common development of ASEAN and Japan in order to solve energy and resource issues.

(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)

・Integration Lecture on Sci・Eng 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.

・Integration Seminar on Sci・Eng 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)

・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 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 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 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 EPAT. (The workshop is the PhD counterpart of the workshop with the identical name for MA students provided by Center for Promotion of International Interactions of Saga University in Organization for General Education.)

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 ASEAN と日本の共発展を目指す T 型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

成長が著しい ASEAN 諸国においては，急速な経済発展に伴う環境・エネルギー・資源問題が深刻である。成長国の健全な発展のために，ASEAN 諸国がそれぞれに抱える課題を十分に把握・分析した上で，なおかつマネジメントも含む総合的な技術開発が求められている。本教育プログラムは，深い専門的研究開発能力の縦軸と，企業的視野と AI・データサイエンスを両翼にもつ「T 字型の高度人材」の育成を目的として，理工学研究科の機械・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において教育と研究指導が行われる。プログラムは，外国人留学生と日本人学生が共学し，環境，エネルギー及び健康科学の専門知識に関する講義，セミナー，およびインターンシップ研修などの教育カリキュラムを全て英語で実施する。本プログラム修了後には，理工学系分野及び医工学系分野の専門的知識と企業的視野，AI・データサイエンスの知識を持ち，環境・エネルギー・資源問題について研究開発やリーダーシップを発揮できる人材として，ASEAN と日本の共発展に貢献していくことが期待される。

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

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，理工統合特別講義，理工統合セミナー，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が開講される。学生はコース専門科目から 1 単位，理工統合特別講義（2 単位），理工統合セミナー（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）

・理工統合特別講義（2 単位）必修

環境科学，エネルギー科学および健康科学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。

・理工統合セミナー（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 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。EPAT の修了要件には含まれない。（佐賀大学国際交流推進センターによって全学教育機構において提供される同名の科目の EPAT 版である）。

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 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