Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Environmental Systems (Master's Program)　(Core Subjects are own-course subjects only)

Course: Resources and Chemical Systems

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
		DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DPⅢ Ability to function autonomously with a solid ethical foundation	DP Ⅰ　Specialist knowledge and skills	DP Ⅱ　Advanced problem-solving and expressive abilities	DPⅢ　Ability to function autonomously with a solid ethical foundation
Common Subjects	Corporate Environmental Management	◎					
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellectual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Fundamental Resources Chemical Systems I (Chemical Process)	◎			This lecuture explains fundamental knowledges in process chemistry, enegetic chemistry, separation and analytical chemistry, and chemical engineering.		
	Fundamental Resources Chemical Systems II (Advanced Material)	◎			Achievement goal: To acquire basic knowledge and techniques on material chemistry, inorganic chemistry, organic chemistry, and physical chemistry, which are essential for research on advanced materials.		
	Fundamental Resources Chemical Systems III (Environmental Process)	◎			You will learn basic theories and techniques that are essential for pursuing in the Resources and Chemical System course.		
Core Subjects	Energy Chemistry	◎	○		This lecture aims at understanding the topics in energy chemistry.	You can think logically about energy chemistry to search for solutions and express your own opinions.	
	Kinetics and Reaction Engineering	◎	○		Thorough study on the theory of chemical reaction kinetics and reaction mechanism for the students to apply it to their own research work.	Presentation by every student about his/her own research from the view point of reaction kinetics and mechanism and discussion with other students.	
	Inorganic Materials Engineering	◎	○		To acquire physicochemical properties and synthesis methods of various inorganic crystalline compounds.	To digest some academic research papers on inorganic compounds written in English.	
	Catalytic Reaction Chemistry	◎	○		To acquire basic knowledge about catalysis based on physicochemical properties of catalysts.	To acquire logical thinking for solving problems in catalytic reactions.	
	X-ray Spectroscopy	◎	○		Acquire knowledge about structural analysis methods using spectroscopy on solid materials.	Acquire insight and judgment regarding crystal structure and symmetry with structural analysis in mind.　Learn techniques for structural display and analysis using software.	
	Separation and Purification Engineering	◎	○		Obtaining professional knowledge for separation and purification technologies and processes of materials.	Obtaining abilities to think comprehensively and to offer solution from professional point of view for the separation and purification methods of materials.	
	Solid State Materials Chemistry	◎	○		Acquire knowledge of "structure" based on crystal chemistry, "physical properties" based on inorganic chemistry and physical chemistry, etc.	To learn symmetry elements and symmetry operations of molecules and crystals, and to acquire the ability to understand spatial structures.	
	Process Design	◎	○		Acquisition of the chemical processes and separation processes	Acquisition of logical thinking ability to grasp individual problems of reaction processes and separation processes	
	Advanced Materials Systems	◎	○		A systematic and comprehensive understanding of advanced material systems.	Being able to think scientifically about the need for advanced materials, seek solutions, and clearly express one's thoughts and judgments.	
	Polymer Chemistry	◎	○		To acquire knowledge on polymer synthesis and physical properties.	To understand the essence of complex problems and to acquire the ability to solve problems based on logical thinking.	
	Environmental Chemistry	◎	○		To understand professional information about principles, function, characteristic and quality control of analytical methods and　equipment for trace chemical analysis in environments.	To achieve the skill to consider the best　method to analyze target materials and to explain the reason.	
	Air Pollution and Its Controlling Engineering	◎	○		To be able to systematically and comprehensively understand the atmosphere, atmospheric science and atmospherc chemistry	To be able to logically and scientifically discuss/consider the air pollution, the atmospheric scinces and their experiments and results	
	Recycling Engineering	◎	○		Relevant technical skills and knowledges for biochemical reactions and material transfer phenomena on biological wastewater treatments.	Skills to calculate biological/phisical/chemical reactions using the process simulator.	
	Aquatic Environment Engineering	◎	○		Comprehensive and systematic understanding about conservation of aquatic environment.	Considering the solution for the problem of aquatic environment and expressing the own idea.	
	Soil and Groundwater Remediation	◎	○		Acquire specialized knowledge of remediation technologies for contaminated soil.	To be able to think comprehensively about soil contamination, explore solutions, and express one's ideas in an appropriate manner.	
	Recycling-System Engineering	◎	○		Acquire advanced knowledge in the recycling field.	Acquire problem-solving skills based on knowledge in the recycling field.	
	Environmental Issues in Asia	○	○	◎	Comprehensive and systematic understanding about environmental problem in Asia.	Considering the solution for the problem in Asia and expressing the own idea about it.	Having the　concern to solve the environmental problem in Asia.
	Sustainable Sanitation Engineering	◎	○	○	Have broad and systematic knowledge of environmental issues in Asia	Provide professional views to find solutions to environmental issues in Asia.	Continue to have professional intentions to solve environmental issues in Asia
	Advanced Resources Chemical Systems I	◎	○	○	A systematic and comprehensive understanding of the resource chemistry system.	Be able to think comprehensively and logically about chemistry and environmental science, seek solutions, and clearly express one's thoughts and opinions from a professional standpoint.	Continue to have an interest in resource chemistry and a career consciousness and acquire an attitude that can contribute to future industries.
	Advanced Resources Chemical Systems II	◎	○	○	A systematic and comprehensive understanding of the resource chemistry system.	Be able to think comprehensively and logically about chemistry and environmental science, seek solutions, and clearly express one's thoughts and opinions from a professional standpoint.	Continue to have an interest in resource chemistry and a career consciousness and acquire an attitude that can contribute to future industries.
Thesis Research	Thesis Research	○	◎	○	Systematically and comprehensively acquire a wide range of knowledge about a given research subject.	Acquire the ability to formulate research plans and evaluate their effects based on logical analysis from chemistry and environmental science perspectives.	Continue to be interested in the research themes to be carried out and acquire an attitude of acting independently to contribute to the future society.

＊For subjects of other course(s) and other graduate program(s), see applicable curriculum map.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Environmental Systems (Master's Program)　(Core Subjects are own-course subjects only)

Course: Biosystems

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
		DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation	DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation
Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental control subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellectual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Fundamental Lecture on Biosystems I (Introduction to Biomaterials)	◎		△	Attendees should acquire the complete fundamental knowledge requiring for specific research area.		Attendees should study hard to acquire knowledge outside from their previous major.
	Fundamental Lecture on Biosystem Ⅱ (Biological and Ecological Engineering)	◎		△	Attendees should acquire the complete fundamental knowledge requiring for specific research area.		Attendees should study hard to acquire knowledge outside from their previous major.
Core Subjects	Environmental Biology	◎	○	○	Students are required to acquire basic and specialized knowledge necessary to understand the relationship between life and the environment.	Students are required to evaluate factors that contribute to various environmental issues from the perspective of biogeochemistry.	Students are required to develop an attitude to discuss various global issues with consideration for life and the environment.
	Introduction to Polymer Physics	◎	○	○	To understand the physical properties of polymers and to acquire the knowledge to develop new materials by applying these properties.	Acquire the basics of polymer material development and its specialized application skills.	To improve interest and motivation in research and development of functional materials and biomaterials.
	Computational Chemistry	◎	○	○	Acquiring the basic knowledge of computational chemistry. Acquiring the skills to use typical computational chemistry software depending on the task.	Capable of thinking computationally and chemically about chemical events, seeking the solutions, and expressing own thoughts logically.	Acquiring an interest continuously in fields such as environment, life, and medical care, a career consciousness, and an attitude of proactive action.
	Biomaterials	◎	○	○	You can acquire specialized knowledge and skills related to biomaterials.	You can acquire the ability to discover problems in the development of biomaterials and logically derive solutions to them.	You can understand the current state of biomaterial development and can contribute to its development.
	Ecosystem Science	◎	○	○	Attendees should master theoretical analysis of ecological phenomena and find out how to apply the theory to their specific research subject.	Attendees are requested to explain how the individual ecological phenomena relates to their specific research topics.	Attendees are requested to understand the bioethics properly based on the ecological theory and to actively practice them in their research field.
	Biosensor Engineering	◎	○	○	Students are required to acquire basic and general knowledge necessary to understand the biological sensor engineering.	Students are required to think logically about the principles of biological sensors and issues in the development. Further, they are required to express them clearly in presentations.	The ability to have the high level of interests and career consciousness in the field of biology and chemistry.
	Functional Microbiology	◎	○	○	The ability to systematically and comprehensively understands the relationship between the physiological functions of microorganisms and the environment or industrial use.	The ability to comprehensively consider how to utilize the functions of microorganisms for fermentation production, bioremediation, and bioconversion. And the ability to propose solutions and send out ideas.	The ability to have the high level of interests and career consciousness in the field of microorganisms, and to act independently to solve various problems related to the environment, food, medical care, etc.
	Ecological and Environmental Physiology	◎	○	○	Knowledge on the chemical and physical interactions between living organisms and the surrounding environments through specific case studies reported to date must be obtained.	Empirical and theroretical approaches towards solving the environmental and biological problems must be understood.	Ethics behind the biological and evironmental sciences and technologies must be leaned.
	Special Lecture on Biosystems	◎	○	○	To acquire a general and systematic knowledge of biosystems area.	To have the abilities to think logically to address the issues in the biosystems area and to clearly explain your opinions from a professional perspective.	To have the interest in biosystems area and to be able to contribute to society.
	Special Seminar on Biosystems I	○	◎	○	Understand the background and purpose of your research theme, and to acquire the knowledge and skills to be able to plan, perform, evaluate, and improve appropriately to achieve it.	Acquire the thinking and judgment skills to appropriately explain your research approach.	Have a strong interest in the research theme and the ability to act in order to achieve the goals.
	Special Seminar on Biosystems II	○	◎	○	Understand the background and purpose of your research theme, and to acquire the knowledge and skills to be able to plan, perform, evaluate, and improve appropriately to achieve it.	Acquire the thinking and judgment skills to appropriately explain your research approach.	Have a strong interest in the research theme and the ability to act in order to achieve the goals.
	Molecular and Cellular Biosciences	◎	○	○	To acquire a wide range of knowledge in the molecular and cellular biology fields, and to acquire the skills to solve the issues.	To have the abilities to find the essential issues in the molecular and cellular biology fields and to explain and present the achievements in papers or at conferences.	To have the autonomy and communication skills to be able to provide appropriate solutions to various issues in the molecular and cellular biology fields through research and collaboration with others.
Thesis Research	Thesis Research	○	◎	○	Students will acquire knowledge and technology to be able to perform a plan, action, evaluation, improvement to achieve research target.	Students can suggest problems and solution in research and development and will acquire an ability to be able to accomplish effectively by collaborating with others.	Students have a strong interest for research target and will acquire the posture capable of acting independently to achieve the purpose.

＊For subjects of other course(s) and other graduate program(s), see applicable curriculum map.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Environmental Systems (Master's Program)　(Core Subjects are own-course subjects only)

Course: Environmental and Ecological Systems

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
		DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation	DP Ⅰ　Specialist knowledge and skills	DP Ⅱ　Advanced problem-solving and expressive abilities	DP Ⅲ　Ability to function autonomously with a solid ethical foundation
Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental control subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellectual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Fundamental Lecture on Environmental and Ecological Systems	◎			To acquire the basic knowledge and skills necessary to study the Environmental and Ecological Systems course.		
Core Subjects	Environmental Economics	◎	○	○	Understand economic and mathematical methods for analyzing environmental problems.	Capable of applying economic methods for environmental problems and identify solutions.	Eager to consider environmental problems from an economist perspective.
	Energy and Environmental Engineering	◎	○	○	Acquire a wide range of knowledge about energy and the environment in a systematic and comprehensive manner.	To be able to think about energy and environmental issues from an interdisciplinary and multifaceted perspective, to seek solutions, and to express one's thoughts and judgments appropriately.	Develop an interest in and career awareness of energy and environmental issues, and an attitude of working to solve problems.
	Sustainable Management Systems	◎	○	○	To get the professional, creative and practical knowledge on various methods of sustainable management.	To be able to make enforcement, judgment and representation from the standpoint of environmental management to environmental issues in the society.	To have the interest and motivation in conduction of specialized research on various issues of sustainable management.
	Environmental Information Technology and Computer Simulation	◎	○	○	To acquire comprehensive expertise and assessment techniques for environmental impact assessment.	To be able to think comprehensively and logically about environmental impact assessment, to seek solutions, and to express one's thoughts and judgments logically.	Maintain an interest and career awareness in the environmental field, and develop an attitude to contribute to the solution of environmental problems in cooperation with other organizations.
	Urban Environmental Assessment and Planning	◎	○	○	Acquire specialized, creative, and practical knowledge in the field of environmental evaluation and decision-making methods that are the basis of urban environmental planning.	In order to deal with actual urban environmental problems, acquire the thinking ability and judgment ability to deal with the problems from a broad perspective not only in Japan but also in developing countries.	Acquire the motivation to practice advanced study while being interested in the balance between urban environmental issues and urban development.
	Safety and Engineering Ethics	◎	○	○	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.	Able to act according to the industry and position, and collaborate and coordinate with others.	Able to develop ethics in the real world.
	Environmental Pollution and Health Risks	◎	○	○	Understand economic and mathematical methods for analyzing environmental problems.	Capable of applying economic methods for environmental problems and identify solutions.	Eager to consider environmental problems from an economist perspective.
	Environmental Issues in Asia	○	○	◎	Comprehensive and systematic understanding about environmental problem in Asia.	Considering the solution for the problem in Asia and expressing the own idea about it.	Having the concern to solve the environmental problem in Asia.
	Sustainable Sanitation Engineering	◎	○	○	Have broad and systematic knowledge of environmental issues in Asia	Provide professional views to find solutions to environmental issues in Asia.	Continue to have professional intentions to solve environmental issues in Asia
	Environmental Biology	◎	○	○	Students are required to acquire basic and specialized knowledge necessary to understand the relationship between life and the environment.	Students are required to evaluate factors that contribute to various environmental issues from the perspective of biogeochemistry.	Students are required to develop an attitude to discuss various global issues with consideration for life and the environment.
	Functional Microbiology	◎	○	○	The ability to systematically and comprehensively understands the relationship between the physiological functions of microorganisms and the environment or industrial use.	The ability to comprehensively consider how to utilize the functions of microorganisms for fermentation production, bioremediation, and bioconversion. And the ability to propose solutions and send out ideas.	The ability to have the high level of interests and career consciousness in the field of microorganisms, and to act independently to solve various problems related to the environment, food, medical care, etc.
	Ecological and Environmental Physiology	◎	○	○	Knowledge on the chemical and physical interactions between living organisms and the surrounding environments through specific case studies reported to date must be obtained.	Empirical and theroretical approaches towards solving the environmental and biological problems must be understood.	Ethics behind the biological and evironmental sciences and technologies must be leaned.
	Ecosystem Science	◎	○	○	Attendees should master theoretical analysis of ecological phenomena and find out how to apply the theory to their specific research subject.	Attendees are requested to explain how the individual ecological phenomena relates to their specific research topics.	Attendees are requested to understand the bioethics properly based on the ecological theory and to actively practice them in their research field.
	Theory and Progress of Sustainable Development	◎	○	○	To acquire knowledge in the field of development of developing countries necessary for advanced professionals.	To be able to understand issues related to economic development in developing countries by putting them in the context of oneself.	Be willing to take the initiative in solving environmental and social problems in developing countries.
Thesis Research	Thesis Research	○	◎	○	Learn how to conduct research and draw conclusions in your field of expertise.	Understand research issues from multiple perspectives and propose necessary solutions.	Have a sense of role as an expert in dealing with environmental issues and be able to work on practical issues.

＊For subjects of other course(s) and other graduate program(s), see applicable curriculum map.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Environmental Engineering (Master's Program)　(Core Subjects are own-course subjects only)

Course: Mechanical Systems Engineering

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
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Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental control subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellectual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Introduction to Mechanical Systems I (Energy Systems)	◎		△	Basic knowledge in the energy system field of the mechanical engineering is acquired.		Students are aware of problems with existing energy equipment and possess their will which solve the problem aggressively
	Introduction to Mechanical Systems II (Design and Manufacturing)	◎		△	To acquire the basic knowledge about the design and manufacturing system systematically and comprehensively.		To have an interest in and a career consciousness of a design and manufacturing system continually, and acquire the posture to contribute to the society as an engineer or a researcher.
Core Subjects	Advanced Fluid Mechanics	◎	△		To acquire basic knowledge on compressible fluid mechanics.	To acquire the ability to independently investigate and summarize a given problem.	
	Advanced Combustion Theory	◎	○	○	To acquire the practical knowledge about the combustion engineering.	To acquire the logical thinking and expressive abilities about the combustion engineering.	To acquire the posture which come into action independently to the problems related to combustion engineering.
	Advanced Optical Diagnostics for Compressible Flows	◎			To acquire specialized knowledge of optics and techniques for optical measurement of compressible fluids.		
	Advanced Heat Transfer	◎	○	○	To acquire advanced knowledge on heat transfer engineering.	To acquire the ability to comprehensively consider heat transfer issues.	To acquire to approach practical problems as a professional engineer.
	Advanced Thermodynamics	◎	△	○	Ppractical knowledge of thermodynamics in the field of energy systems of mechanical engineering is acquired.	Students put on the high thinking power and judgement in the harmony with the environment in development and design of energy equipment.	Students have a strong interest and motivation for technological development of energy equipment for environmental problems.
	Advanced Control Engineering	◎	△		To acquire practical knowledge about the control engineering systematically and generally.	To consider logically, search a solution, and express it, about control engineering.	
	Advanced Mechatronics	◎	△		To acquire comprehensive knowledge of mechatronics systematically and practically.	To be able to think logically, explore solutions to mechatronics problems.	
	Advanced Design Engineering	◎	△		To acquire professional knowledge about finite element method (FEM), and to acquire ability to apply FEM to practical problem of structural analysis.	To acquire logical thinking ability and accurate expression ability about analysis results.	
	Advanced Manufacturing Processes	◎	△	△	Students have practical knowledge and technical development skills necessary for precision machining, such as ultra-precision machining and ultra-precision measurement.	Students have practical knowledge such as environmentally friendly machining technology, and acquire the ability to think and make decisions that enable them to deal with new problems from a broad perspective based on the environment.	Students continue to be interested and motivated in new technology of energy efficiency, and have the attitude to act proactively as mechanical engineers to acquire the technology of energy efficiency in the machining field.
	Advanced Mechanics of Materials	◎	△		Specialized and practical knowledge of mechanics of materials used in product design is acquired.	Students will be able to design actual products based on the specialized and practical knowledge of mechanics of materials they have acquired, and will be able to summarize and express what they have learned.	
	Advanced Machine Element Design	◎	△	△	To acquire the basic specialist knowledge of various machine elements.	A comprehensive understanding of machine elements design for machining a wide variety of machine parts and the ability to express the knowledge gained logically.	To have a maintain an interest in mechanical system design and be motivated to become a mechanical engineer.
	Advanced Systems Engineering	◎	○	△	To acquire wide and technical knowledge about system construction.	To consider overall about mechatronics systems, to explain the idea accurately, and to explain the idea as a mechanical design.	To have an interest in mechanical system construction and in studies of mechanical system engineering.
	Advanced Mechanical Dynamics	◎	△		To acquire comprehensive knowledge of problems of mechanical dynamics.	To be able to understand mechanics problems and give logical explanation for solving problems.	
	Advanced Leading Engineering	◎	○	○	Students comprehensively acquire basic knowledge about maintenance of mechanical systems. They are possible to collect and analyze the information necessary for introducing new maintenance technologies using high-sensitivity sensors, IoT, and AI technologies.	Students are possible to think interdisciplinarily and compoundly about new maintenance technology, search for solutions, and propose application plans from each individual's professional point of view.	Students continue to have an interest in stable operation of mechanical systems in society and a career consciousness, and have acquired an attitude that can contribute to the realization of advanced operation methods.
Thesis Research	Thesis Research	○	◎	○	To acquire technical knowledge and skills of mechanical engineering, and practical skills in each research field.	To search for a problem in each field of mechanical engineering, and to acquire the ability to resolve it.	To keep the interest in each field of mechanical engineering, and to have the posture for contributing to the society as a responsible engineer or researcher.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Environmental Engineering (Master's Program)　(Core Subjects are own-course subjects only)

Course: Architecture

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Subject Category	Class Subject	Diploma Policy			Diploma Policy		
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Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental c ontrol subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellect ual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Introduction to Residential Environmental Design	◎			Acquire the basic specialized knowledge necessary for designing residential environments.		
	Introduction to Engineering for Building Structures, Building Materials and Building Construction	◎	△		Students should acquire the basic knowledge of structural and maintenance engineering necessary for starting their master's thesis research.	Students should be able to think logically, seek solutions, and express them from a professional standpoint in advancing research in the field of structural and maintenance engineering.	
	Introduction to Energy Systems in Urban Architecture	◎	△		Acquire the basic knowledge of energy systems in urban architecture.	Acquire the ability to think logically, seek solutions, and express from a professional standpoint in the field of urban building environmental energy.	
Core Subjects	Architectural Design Program	○	○	○	Acquire the design skills and basic specialized knowledge necessary for architectural design.	Understand space in three dimensions, and acquire the ability to express space in three dimensions necessary for architectural presentation.	Acquire the willingness and attitude to engage in problem solving based on the sense of ethics as an engineer who practices architectural design.
	Ecological Design for the Urban Environment	○	◎	○	At the end of the course, participants are expected to (1) Acquire more practical and advanced expertise in urban development that considers resource saving, energy saving, and coexistence with nature,	(2) Be able to think interdisciplinary about environmentally symbiotic city, search for solutions, and express their ideas appropriately,	(3) Have an interest in urban design and motivation to work towards realization of environmentally symbiotic cities.
	Advanced Trans-Generational Architecture	◎	△	○	Acquire specialized knowledge about the sustainability of architecture that creates space from the past to the future.	Acquire judgment and expressiveness to utilize the knowledge and skills learned in class.	Keep an interest in building a sustainable social system and a career consciousness as a building engineer, and acquire an attitude of being able to act independently.
	Environmental and Spatial Design	◎	△	○	Obtain specialized knowledge about the Arc hitectural design. Apply theories or technics to real design fields based on the historical background.	Solve development challenges by reconstruc ting theorical thinking and known knowledge . Evaluate required studies in terms of their methods, contents, value.	Produce reliable proposals with ethics in soc iety.
	Construction Engineering and Management	◎	○	○	Graduate students should acquire advanced theoretical and practical knowledge necessary for construction engineering and management systematically and comprehensively.	Regarding social matters in construction engineering and management, graduate students should acquire the ability to find problems and solve them theoretically, the ability to convey one's thoughts, and the communication ability to collaborate with others to organize projects.	Graduate students should acquire the motivation and attitude to work on problem solving based on ethical viewpoint as an engineer who practices construction engineering and management.
	Advanced Environmentally Conscious Materials Engineering	◎	○		At the end of the course, participants are expected to (1) Obtain practical knowledge about environment-conscious materials and skills to analyze survey results and data,	(2) Apply problem-solving ability learned in the course to real world problems.	
	Structural Analysis	◎			Systematically and comprehensively acquire specialized knowledge on structural analysis.		
	Advanced Building Materials	◎	△		Students should acquire more practical expertise in building materials and have the skills to summarize and analyze survey materials and numerical data related to building materials.	By making full use of the specialized skills gained in class, students should be able to extract international issues related to building materials and should acquire the expressive power to disseminate their solutions to society.	
	Structural Design for Buildings	◎			Students acquire systematic and comprehensive understanding of building structural design.		
	Earthquake Resistant Structures	◎			Students acquire understanding of specialized theories of mechanics (principle of work and energy), plasticity analysis and buckling theory.		
	Building Facilities Systems	◎	○	○	Acquire the skill for performance prediction and analysis of energy saving technology.	Acquire the ability to solve problems through communicate with others.	Acquire the skill to create documents based on the knowledge and sense of ethics as an engineer.
	Theories of Urban and Building Energy Systems	◎	○	○	Acquire practical expertise in urban energy. Acquire the skills to compile survey materials related to urban energy.	Acquire the expressive power to demonstrate the skills acquired in class in society. Acquire the ability to communicate with others and solve problems.	To be able to have an ethical sense of creating highly reliable materials based on the theory and experience.
	Advanced Architectural Acoustics and Lighting Design	◎			To acquire the practical expertise for the acoustical and lighting planning and the simulation technique.		
	Advanced Thermal and Air Environmental Design	◎	○	△	Students will acquire the expertise in the formation mechanism of thermal and air environments.	Students will acquire skills related to numerical analysis and prediction methods for basic equations that govern the thermal and air environments.	Students will acquire the ability to solve environmental problems in addition to thinking and judgment to apply the knowledge and skills gained through class.
	Architectural Engineering Practice	○	◎	○	Acquire expertise in architecture. Acquire technology to solve architectural problems.	Acquire thinking and judgment to achieve results by tackling problems. Acquire the ability to communicate with others and solve problems.	To be able to have an ethical sense of creating highly reliable materials based on the theory and experience.
	Architectural Internship	◎	○	○	At the end of the course, participants are expected to (1) Obtain practical knowledge through practice,	(2) Obtain practical thinking, discernment, and expressiveness through practice,	(3) Recognize importance of trust and responsibility, and obtain ethics through practice.
	Low Carbon Architecture and Urban Design	○	◎	○	Acquire more practical and advanced expertise in low-carbon architecture and urbanism.	Acquire practical expression skills through case studies and presentations on low-carbon architecture and cities.	Understand the significance and importance of contributing to the global environment, take an interest in environmental issues at the architectural and urban levels, and acquire high ethical standards.
Thesis Research	Thesis Research	○	◎	○	At the end of the course, participants are expected to (1) Obtain advanced specialized knowledge through research in specialized field,	(2) Be able to solve problems with other researchers,	(3) Recognize importance of problem-solving with ethics, and apply in the real world problems.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Information Engineering (Master's Program)　(Core Subjects are own-course subjects only)

Course: Computer Science

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
		DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation	DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation
Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental c ontrol subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellect ual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Introduction to Computer Science	○			Acquire the specialized knowledge in computer science, especially in artificial intelligence, information and communication, information security, modeling, and data science.		
Core Subjects	Information Security	◎	△	○	Learn specialized knowledge of information security.	Consider logically, explore solutions, and express their opinions from a professional perspective in an appropriate manner.	Have interest in information security and career consciousness, and acquire an attitude to act independently as a researcher.
	Applied Pattern Recognition	◎	△	○	Acquisition of basic and specialized knowledge in pattern recognition	Enabling to inquire into issues regarding pattern recognition and suggest their solution	Continuing to have an interest in pattern recognition and a motivation for developing new technologies
	Adaptive Signal Processing	◎	△	○	Students have acquired general specialized knowledge in the field of information technology, especially adaptive signal processing and artificial intelligence, and have acquired skills in designing and implementing signal processing in instrumentation and communication systems.	Students will be able to develop effective adaptive processing algorithms for system design, evaluate their performance in practical applications, and present these processes in an academic paper.	As researchers in the field of computer science, students have the ability to communicate effectively with others in the community and organization and act autonomously to deal with the practical signal processing problems based on a sense of social responsibility and ethics.
	System Control Theory	◎	△	○	To systematically and comprehensively understand the control theory of linear systems based on the state-space representation.	To find solutions to the problems of the control system design by applying the system control theory and present the solutions clearly.	To keep having an interest and career awareness in the control system design, and be willing to design control systems applying the system control theory.
	Theory of Dynamic Systems	◎	△	○	Learn fundamental knowledge on state estimation problems of dynamical systems in a systematic and complehensive way.	Can find a reasonable way to estimate states of the system and evaluate its effectiveness.	Have interests on a new technology and theory, and be eager to learn them.
	Theory of Combinatorial Optimization	◎	△	○	To obtain the essential knowledge and expertise of combinatorial optimization.	To obtain that the problem of the combinatorial optimization is inquired and its solution is shown.	To obtain that the deep knowledge of combinatorial optimization is obtained and the development of its novel optimization is motivated.
	Sparse Modeling	◎	△	○	You can study basic knowledge and expertise in sparse modeling	You can explore issues related to sparse modeling and show how to solve them.	You will be continuously interested in sparse modeling and motivated to develop new technologies.
	Software Engineering	◎	○	○	Students acquire a wide range of specialized knowledge in software engineering systematically and comprehensively.	Students have the skills to acquire advanced expertise in software engineering on their own.	Students should be able to think comprehensively about software engineering, explore solutions, and express their ideas logically from a professional perspective.
	Software Verification	◎	△	○	Acquire specialized knowledge on software verification.	Acquire specialist skills to perform software verification.	Acquire ability to plan software verification and evaluate its effectiveness based on logical analysis from the perspective of software verification.
	Soft Computing	◎	△	○	Acquire specialized knowledge of soft computing.	Consider logically and explore solutions, and express their opinions from a professional perspective in an appropriate manner.	Have interest in soft computing and career consciousness, and acquire an attitude to act independently as a researcher.
	Software for Embedded Systems	◎	△	○	Students acquire a wide range of specialized knowledge about embedded software.	Students understand the fundamental skills required to assemble embedded software.	Students can take an interdisciplinary manner to search for solutions on embedded software.
	Visual Information Processing	◎	△	○	Broad knowledge about visual information processing of human and machinery	Ability to express one's own opinion clearly about the issues concerning visual information processing	Ability to access recent topics about visual information processing based on one's own interest
	Introduction to Sensory Measurement	◎	△	○	Students have basic knowledge about measuring sensation and perception.	Students can think of sensation and perception globally, explore the solution, and express their own idea clearly.	Students maintain their interest in sensation and perception, and can think of human-friendly manufacturing.
	Behavior Analysis	◎	△	○	Understand the general perspective on data in behavior science.	Skilled to plan experiments for behavior science to obtain analyzable data.	Handlable personal information regarding benefits and risks.
	Network Architecture	◎	△	○	Systematically and Comprehensively recognize specialized knowledge about network architecture.	Comprehensively explore solutions, and logically describe your opinions and judgments from a professional viewpoint of network architecture.	Strongly concern network architecture and career consciousness, and desire to develop new technologies.
	Image Processing	◎	△	○	Learn fundamental and specialized knowledge on image processing.	Find issues related to image processing and show its solutions.	Have interest in learning deepen knowledge, and developing new technologies in image processing.
	Information and Communication Theory	◎	△	○	Acquire specialized knowledge on understanding information and coding theory.	Explore solutions and clearly express their opinions on issues related to information and communication theory.	Have interest in information and communication technology and a career consciousness of it, and acquire an attitude to contribute.
	Signal Analysis	◎	△	○	Learn systematic and comprehensive knowledge of the fundamentals of signal analysis.	Consider logically, explore solutions of research problems, and clearly express their opinions and judgments from a signal analysis perspective.	Have interest in signal analysis, and acquire an attitude of proactive action.
Thesis Research	Thesis Research	○	◎	○	Acquisition of basic academic skills and specialized knowledge in computer science as well as the ability to design and implement information systems as a master's degree in the research field.	Develop a solution for issues in the field of computer science, and derive a conclusion by evaluating the performance of the practical results, and write an academic paper by summarised these processes.	As a researcher in the field of computer science, communicate effectively with others in community and organizations, and work autonomously to solve problems based on a sense of social responsibility and ethics.

＊For subjects of other course(s) and other graduate program(s), see applicable curriculum map.

Curriculum Map: Graduate School of Environmental Engineering
Graduate Programs in Information Engineering (Master's Program)　(Core Subjects are own-course subjects only)

Course: Applied Information Systems

◎:Closely related　○:Related　△:Somewhat related

Subject Category	Class Subject	Diploma Policy			Diploma Policy		
		DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation	DP Ⅰ Specialist knowledge and skills	DP Ⅱ Advanced problem-solving and expressive abilities	DP Ⅲ Ability to function autonomously with a solid ethical foundation
Common Subjects	Corporate Environmental Management	◎			To do the jobs in charge of environmental c ontrol subsection chief in the factories.		
	The Creation, Protection and Utilization of Intellectual Property	◎			To acquire practical knowledge that enables understanding and utilization of the intellect ual property rights system.		
	Academic Presentation Ⅰ	○	◎		Communicate in English in academic situations.	Use appropriate expressions to present research findings.	
	Academic Presentation Ⅱ	○	◎		Communicate in English in academic situations.	Organize ideas in an effective manner to report and discuss research findings.	
	Safety and Engineering Ethics	○		◎	Acquire practical skills such as problem finding and risk quantitative estimation, industry and position-based behavior, and collaboration and coordination with others.		Able to develop ethics in the real world.
	Environmental Principles	◎			Acquire several thinking frameworks for understanding and acting on environmental issues from multiple perspectives.		
	Internship	○	○	◎	Acquisition of background and skills required as a specialist in each field through practical off-campus training	Acquisition of thinking ability, self-expression ability, and judgment ability based on comprehensive view required in the practical field	Acquisition of strong interest and motivation for the career and acquisition of ability to solve problems arisen in the practical field
Basic Subjects	Introduction to Applied Information Systems	○			Acquire basic knowledge of the research area, including VLSI, embedded systems, medical engineering, and recognition.		
Core Subjects	Information Security	◎	△	○	Learn specialized knowledge of information security.	Consider logically, explore solutions, and express their opinions from a professional perspective in an appropriate manner.	Have interest in information security and career consciousness, and acquire an attitude to act independently as a researcher.
	Applied Pattern Recognition	◎	△	○	Acquisition of basic and specialized knowledge in pattern recognition	Enabling to inquire into issues regarding pattern recognition and suggest their solution	Continuing to have an interest in pattern recognition and a motivation for developing new technologies
	Adaptive Signal Processing	◎	△	○	Students have acquired general specialized knowledge in the field of information technology, especially adaptive signal processing and artificial intelligence, and have acquired skills in designing and implementing signal processing in instrumentation and communication systems.	Students will be able to develop effective adaptive processing algorithms for system design, evaluate their performance in practical applications, and present these processes in an academic paper.	As researchers in the field of computer science, students have the ability to communicate effectively with others in the community and organization and act autonomously to deal with the practical signal processing problems based on a sense of social responsibility and ethics.
	System Control Theory	◎	△	○	To systematically and comprehensively understand the control theory of linear systems based on the state-space representation.	To find solutions to the problems of the control system design by applying the system control theory and present the solutions clearly.	To keep having an interest and career awareness in the control system design, and be willing to design control systems applying the system control theory.
	Theory of Dynamic Systems	◎	△	○	Learn fundamental knowledge on state estimation problems of dynamical systems in a systematic and complehensive way.	Can find a reasonable way to estimate states of the system and evaluate its effectiveness.	Have interests on a new technology and theory, and be eager to learn them.
	Theory of Combinatorial Optimization	◎	△	○	To obtain the essential knowledge and expertise of combinatorial optimization.	To obtain that the problem of the combinatorial optimization is inquired and its solution is shown.	To obtain that the deep knowledge of combinatorial optimization is obtained and the development of its novel optimization is motivated.
	Sparse Modeling	◎	△	○	You can study basic knowledge and expertise in sparse modeling	You can explore issues related to sparse modeling and show how to solve them.	You will be continuously interested in sparse modeling and motivated to develop new technologies.
	Software Engineering	◎	○	○	Students acquire a wide range of specialized knowledge in software engineering systematically and comprehensively.	Students have the skills to acquire advanced expertise in software engineering on their own.	Students should be able to think comprehensively about software engineering, explore solutions, and express their ideas logically from a professional perspective.
	Software Verification	◎	△	○	Acquire specialized knowledge on software verification.	Acquire specialist skills to perform software verification.	Acquire ability to plan software verification and evaluate its effectiveness based on logical analysis from the perspective of software verification.
	Soft Computing	◎	△	○	Acquire specialized knowledge of soft computing.	Consider logically and explore solutions, and express their opinions from a professional perspective in an appropriate manner.	Have interest in soft computing and career consciousness, and acquire an attitude to act independently as a researcher.
	Software for Embedded Systems	◎	△	○	Students acquire a wide range of specialized knowledge about embedded software.	Students understand the fundamental skills required to assemble embedded software.	Students can take an interdisciplinary manner to search for solutions on embedded software.
	Visual Information Processing	◎	△	○	Broad knowledge about visual information processing of human and machinery	Ability to express one's own opinion clearly about the issues concerning visual information processing	Ability to access recent topics about visual information processing based on one's own interest
	Introduction to Sensory Measurement	◎	△	○	Students have basic knowledge about measuring sensation and perception.	Students can think of sensation and perception globally, explore the solution, and express their own idea clearly.	Students maintain their interest in sensation and perception, and can think of human-friendly manufacturing.
	Behavior Analysis	◎	△	○	Understand the general perspective on data in behavior science.	Skilled to plan experiments for behavior science to obtain analyzable data.	Handlable personal information regarding benefits and risks.
	Medical Engineering	◎	△	○	Understand the electronic information technology required for medical engineering and have basic skills that can be used concretely.	Be able to explore challenges in biomedical engineering and show solutions.	Understand the safety and personal information protection required for medical engineering, understand it as a technically necessary issue, and develop it.
	Design for Testability	◎	△	○	Acquire basic knowledge on LSI test pattern generation algorithms, and design verification algorithms.	Acquire core technologies that improve the reliability of LSIs.	Will continue to be interested in the semiconductor industry and independently learn the LSI operation analysis technology.
	VLSI Physical Design	◎	△	○	Systematically and comprehensively understand the specialized knowledge of physical design in the VLSI design process.	Acquire the skills to design the layout of small-scale integrated circuits by using a dedicated system for VLSI design.	Think about the semiconductor industry and its development from an engineer's point of view, and act autonomously to learn the necessary technologies for the future.
	Mobile Communication Systems	◎	△	○	Gain a wide range of expertise in mobile communication systems.	Ability to express their opinions clearly about various issues of mobile communication systems.	Ability to design mobile communication systems, explore solutions, and express their opinions logically from a professional perspective.
	Embedded Hardware Systems	◎	△	○	Fundamental knowledge on embedded hardware.	Ability to seek a solution with comprehensive and logical thinking and to logically express their own opinions.	Ability to keep having an iteresr on embedded hardware and to independenty act as an IT engineer.
Thesis Research	Thesis Research	○	◎	○	Acquire wide-range knowledge of information systems systematically.	For the issues of the information systems, explore their solutions from the professional perspective and express their own opinions and conclusions logically.	Interest in the information systems and conduct their research activity independently.

＊ For subjects of other course(s) and other graduate program(s), see applicable curriculum map.