

2025 SUBJECTS (Engineering)

Table (Article 10)

Doctoral Program

Material, Structural and Energy Engineering

AREAS OF STUDY	REQ OR ELEC.	SUBJECT CODE	SUBJECT	CREDITS	HOURS PER WEEK	YEARS	SEMESTERS	SUBJECT DESCRIPTION
COMMON	REQUIRED	ESMSE21010	Dissertation I on Material, Structural and Energy Engineering	3	6	1	Fall & Spring	This subject teaches the research literacy necessary for conducting research in the doctoral program. In addition to methods for setting and solving problems, students will learn how to evaluate research results in terms of novelty, usefulness, and how to evaluate and discuss the results of experiments.
		ESMSE23010	Dissertation II on Material, Structural and Energy Engineering	3	6	2	Fall & Spring	This subject teaches the research literacy necessary for conducting research in the doctoral program. In addition to methods for setting and solving problems, students will learn how to evaluate research results in terms of novelty, usefulness, and how to evaluate and discuss the results of experiments.
PROCESSING DEVELOPMENT ENGINEERING	ELECTIVE	ESMSE26190	Materials for Sustainable Engineering	2	2	1~3	Fall	This lecture focuses on corrosion degradation of materials under various environments.
		ESMSE26130	Special Topics in Manufacturing Process	2	2	1~3	Spring	This lecture focuses the analysis and design of polymer composites materials in manufacturing system.
		ESMSE26110	Advanced Computational Mechanics	2	2	1~3	Fall	This lecture focuses on analyses based on FEM and physics-based model for elastoplastic deformation and dislocation.
		ESMSE25180	Advanced Building Materials and Information Engineering	2	2	1~3	Spring	This lecture focuses on the material property and degradation of concrete from the perspective of materials buildings and computational engineering.
		ESMSE26100	Advanced Material Function Development of New Construction Material	2	2	1~3	Spring	This lecture focuses on durability of concrete and rheology of fresh concrete.
		ESMSE25100	Advanced Steel Structures	2	2	1~3	Fall	The objectives of this lecture are to have fundamental knowledge on steel materials and steel structures, to develop a basic understanding of the design of steel structures.
		ESMSE25120	Advanced Reinforced Concrete Structures	2	2	1~3	Spring	This lecture focuses on confined Concrete, flexural strength, shear resistance mechanism and collapse mechanism.
		ESMSE26120	Advanced Electronic Functional Materials	2	2	1~3	Fall	This lecture focuses on the synthesis and properties of inorganic functional materials. Moreover, electrical and optical applications of functional materials are discussed.
		ESMSE26140	Advanced Plasma Engineering	2	2	1~3	Fall	This lecture focuses on the basic approaches to plasma production and control. Moreover, various aspects of plasma processes are introduced.
		ESMSE25110	Organic Electronics Device Engineering	2	2	1~3	Spring	Lectures on properties of organic electronics materials and physics of organic electronics devices.
		ESMSE26170	Advanced Ferromagnetic Materials	2	2	1~3	Fall	Study on the magnetic domain structure and its observation techniques, and relating phenomena are discussed.
		ESMSE26180	Quantum Physics of Materials	2	2	1~3	Fall	The students will study the basic electron theory in solids.
		ESMSE25140	Geo-Disaster Engineering	2	2	1~3	Spring	Lecture on the geo-disaster induced by rainfall and earthquake and tsunami.
		ESMSE25150	Nonlinear Structural Analysis	2	2	1~3	Spring	This lecture focuses on nonlinear structural analysis as nonlinear finite element method and material modeling.
		ESMSE25160	Advanced Electronic Devices	2	2	1~3	Spring	Lecture on the various devices that constitute ICs, as well as optical devices, communication devices, power devices, sensors, etc.
		ESMSE25170	Advanced Molding Process	2	2	1~3	Spring	This lecture focuses on the molding process using metal, polymer and powder.
		ESMSE26210	Advanced Geosphere Engineering	2	2	1~3	Fall	This course covers the physicochemical properties of geomaterials, groundwater contamination, and geotechnical approaches to address the issues.
ENERGY DEVELOPMENT ENGINEERING	ESMSE26530	Advanced Heat Transfer Engineering	2	2	1~3	Spring	Advanced lecture on heat and mass transfer by turbulent flow of a forced convection or a conduction phenomena.	
	ESMSE25520	Advanced Study on Transport Phenomena	2	2	1~3	Spring	Steady-state molecular diffusion, Transient diffusion, Mass transfer associated with chemical reaction, Convective mass transfer, Mass transfer equipment.	
	ESMSE26510	Advanced Fluid Dynamics	2	2	1~3	Fall	Lecture on the concept of high speed gas flow and shock waves using the governing equation of fluid dynamics and thermodynamics.	
	ESMSE26520	Advanced Computational Fluid Dynamemics	2	2	1~3	Fall	The course gives numerical simulations of three dimensional fluid flows, the discrete element method for motions of solid particle goup, and parallel computation methods for large-scale simulations.	
	ESMSE25560	Advanced Control of Electric Power Energy	2	2	1~3	Spring	The students will study the energy conversion between electricity and others. In addition, control methods by power electronics technology are discussed.	
	ESMSE26150	Time Series Analysis	2	2	1~3	Fall	Time series is the random data changing with time. In this lecture, we introduce theory, methods and application of time series analysis.	

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Material, Structural and Energy Engineering

AREAS OF STUDY	REQ OR ELEC.	SUBJECT CODE	SUBJECT	CREDITS	HOURS PER WEEK	YEARS	SEMESTERS	SUBJECT DESCRIPTION
ENERGY DEVELOPMENT ENGINEERING	ELECTIVE	ESMSE25500	Strongly-Correlated Materials Science	2	2	1~3	Spring	Fundamentals and applications of strongly-correlated materials science are introduced using English textbooks.
		ESMSE25510	Properties of Condensed Matter under Multiple-Extreme Conditions	2	2	1~3	Spring	Overview of transport, magnetic and thermal properties in heavy fermion system around quantum critical point, and introduction of methods of obtaining low temperatures and high pressures.
		ESMSE25550	Magnetism in Condensed Matter Physics	2	2	1~3	Spring	Lecture on magnetism and phase transition in quantum spin systems.
		ESMSE25540	Advanced Magnetic Resonance in Solids	2	2	1~3	Spring	Advanced lecture on NMR and NQR spectroscopy for strongly correlated electron systems.
COMMON		ESMSE25010	Special Field Works	2	2	1~3	Fall & Spring	In this class, students will learn methodologies for planning, executing, and managing field works and research projects through PBLs.
		ESMSE25020	Special Educational Training	2	2	1~3	Fall & Spring	The lecture provides a chance for educational training. The contents of the class will be determined by discussion.
		ESMSE26900	Special Lecture on Material, Structural and Energy Engineering I-III	1	1	1~3	Fall & Spring	The lecture gives various current topics on Interdisciplinary Structure and Energy Engineering.
		ESMSE26910	Special Lecture on Material, Structural and Energy Engineering IV-VI	2	2	1~3	Fall & Spring	The lecture gives various current topics on Interdisciplinary Structure and Energy Engineering.
		ESMSE26020	Internship I	1	1 week (1 ~ 3 Year) Fall & Spring		Internship at overseas companies, universities or institutions (international students may choose Japanese organizations). Students are trained under the supervision of a supervisor or a person in charge of the study. However, international students cannot train in their country of origin.	
		ESMSE26030	Internship II	1	1 week (1 ~ 3 Year) Fall & Spring		Internship at overseas companies, universities or institutions (international students may choose Japanese organizations). Students are trained under the supervision of a supervisor or a person in charge of the study. However, international students cannot train in their country of origin.	

Requirements for course completion:

Students must obtain 12 or more credits, 3 of which must be obtained from Dissertation I on Material, Structural and Energy Engineering and 3 of which must be obtained from Dissertation II on Material, Structural and Energy Engineering. However, credits for Internship I and II cannot be included in the completion requirements. In addition to receiving the necessary instruction, students must also receive a passing grade on final examinations and Doctoral dissertation.

2025 SUBJECTS (Engineering)

Table (Article 10)

Doctoral Program

Interdisciplinary Intelligent Systems Engineering

AREAS OF STUDY	REQ OR ELEC.	SUBJECT CODE	SUBJECT	CREDITS	HOURS PER WEEK	YEARS	SEMESTERS	SUBJECT DESCRIPTION
COMMON	REQUIRED	ESIS21010	Dissertation I on Interdisciplinary Intelligent Systems Engineering	3	6	1	Fall & Spring	This subject teaches the research literacy necessary for conducting research in the doctoral program. In addition to methods for setting and solving problems, students will learn how to evaluate research results in terms of novelty, usefulness, and how to evaluate and discuss the results of experiments.
		ESIS23010	Dissertation II on Interdisciplinary Intelligent Systems Engineering	3	6	2	Fall & Spring	This subject teaches the research literacy necessary for conducting research in the doctoral program. In addition to methods for setting and solving problems, students will learn how to evaluate research results in terms of novelty, usefulness, and how to evaluate and discuss the results of experiments.
		ESIS25010	Special Field Works	2	2	1~3	Fall & Spring	In this class, students will learn methodologies for planning, executing, and managing field works and research projects through PBLs.
		ESIS25020	Special Educational Training	2	2	1~3	Fall & Spring	The lecture provides a chance for educational training. The contents of the class will be determined by discussion.
		ESIS26900	Special Lecture on Interdisciplinary Intelligent Systems Engineering I-III	1	1	1~3	Fall & Spring	The lecture gives various current topics on Interdisciplinary Intelligent Systems Engineering.
		ESIS26910	Special Lecture on Interdisciplinary Intelligent Systems Engineering IV-VI	2	2	1~3	Fall & Spring	The lecture gives various current topics on Interdisciplinary Intelligent Systems Engineering.
		ESIS26020	Internship I	1	1 week (1 ~ 3 Year) Fall & Spring		Internship at overseas and domestic companies, universities or institutions. Students are trained under the supervision of a supervisor or a person in charge of the study.	
		ESIS26030	Internship II	1	1 week (1 ~ 3 Year) Fall & Spring		Internship at overseas and domestic companies, universities or institutions. Students are trained under the supervision of a supervisor or a person in charge of the study.	
	ELECTIVE	ESIS26110	Advanced Theory of Community Living Space Planning	2	2	1~3	Fall	Theory of urban planning and regional planning with a point of view of community development.
		ESIS25100	Advanced Urban and Regional Planning System	2	2	1~3	Spring	Urban and regional planning system is for learning the planning systems, existing systems, analysis method on each case in several countries.
		ESIS25110	Advanced Regional Planning Systems and Methodology	2	2	1~3	Spring	Planning systems and methodology on environmental creation, disaster risk management and traffic management considering regional characteristics are illustrated and discussed in the class.
		ESIS25120	Advanced Acoustic Architectural Design	2	2	1~3	Spring	Explanation of assessment of the architectural design and disposition of the acoustic material.
		ESIS25130	Advanced Parallel and Distributed Systems	2	2	1~3	Spring	We discuss architectures, system softwares, and algorithms for parallel and distributed systems and investigate their advanced research.
		ESIS25140	Advanced Emergent and Intelligent Robotics	2	2	1~3	Spring	An overview of emergent and intelligent robots that introduces some of its concepts, backgrounds, control, architecture, and intelligence.
		ESIS25150	Advanced Mathematical Modeling	2	2	1~3	Spring	Advanced lecture on mathematical statistics, computational statistics, data science, bio science and human behavior modeling.
		ESIS26130	Innovative HCI	2	2	1~3	Fall	Learn design methods, models and system evaluation methods in Human-Computer Interaction, and deepen discussions based on the latest research results.
		ESIS26140	Advanced Image Processing	2	2	1~3	Fall	Lecture and practice on advanced image processing combined with machine learning, computational intelligence and cognitive science will be discussed.
		ESIS26160	Noncommutative Geometry	2	2	1~3	Fall	We study the general theory of C*-algebras and their K-theory and KK-theory. As applications, we study some topics in Noncommutative Geometry.
ENVIRONMENT AND INFORMATION ENGINEERING		ESIS25170	Introduction to Numerical Relativity	2	2	1~3	Spring	A course for studying formulations and methods for numerically solving Einstein's equation coupled with the equations for relativistic fluid.
		ESIS26170	Physics of Correlated Electrons	2	2	1~3	Fall	This lecture is designed to understand the origin of phenomena derived from electron correlation, such as heavy fermion, multipole ordering, unconventional superconductivity.
		ESIS26180	Introduction to the Structure of Space-time	2	2	1~3	Fall	Advanced general relativity and the structure of space-time.
		ESIS25510	Advanced Intelligent Control Systems	2	2	1~3	Spring	This special lecture provides some control methods, fuzzy control, neural-network, Kalman filter, and H-infinity control, for nonlinear time-variant systems. Some optimization methods are also lectured.
		ESIS26510	Advanced Asynchronous Systems	2	2	1~3	Fall	Asynchronous system that over comes the clock skew, power consumption and reliability problems, and its mathematical bases and novel design techniques are mentioned and discussed in this subject.
		ESIS25520	Advanced Biomedical Engineering	2	2	1~3	Fall	The lecture provides intensive coverage of theory of system design with the application to biomedical devices. Topics covered include: basic electronics circuits, biomedical sensors, medical instrumentation, therapeutic and prosthetic devices. It covers principles and applications of brain-computer-interface.

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Interdisciplinary Intelligent Systems Engineering

AREAS OF STUDY	REQ OR ELEC.	SUBJECT CODE	SUBJECT	CREDITS	HOURS PER WEEK	YEARS	SEMESTERS	SUBJECT DESCRIPTION
ELECTRONICS AND INFORMATION ENGINEERING	ELECTIVE	ESIIS26520	Advanced Computer Control Theory	2	2	1~3	Fall	Robust control, H-infinity control, H2 control, mu-synthesis, LMI's and Controller order reduction.
		ESIIS26530	Advanced Electrical Systems Engineering	2	2	1~3	Fall	This lecture provides the specialized research field of electrical systems engineering, and will deepen the discussion based on the latest research results.
		ESIIS26540	Advanced Intelligent Systems	2	2	1~3	Fall	We discuss intelligent system technology. In particular we focus on machine learning neural network, collective intelligence and multi-agent system.
ESIIS25540		Advanced Machine Learning	2	2	1~3	Spring	This lecture describes basic concepts in machine learning and data mining, and then introduces examples of applications.	
ESIIS26550		Advanced Information Theory	2	2	1~3	Fall	Special lectures on sparse modeling, distributed source coding, information and communication security. Deepen discussions based on the latest research results.	
ESIIS26560		Elliptic Hypergeometric Function Theory	2	2	1~3	Fall	Various summation and transformation formulae for the q-analog of the hypergeometric series are explained. The elliptic analog of the hypergeometric series is also studied in detail.	
ESIIS26570		Advanced Algebraic Topology	2	2	1~3	Fall	Study of topological aspects of the space of rational functions from the Riemann sphere to complex manifolds.	
ESIIS25550		Representation Theory	2	2	1~3	Spring	We discuss the alpha-determinant, which is a parametric deformation of the determinant and permanent, from the representation-theoretic point of view. We study basic properties of the alpha-determinant, representation theory of the symmetric groups and general linear groups, and the structure of cyclic modules generated by the alpha-determinants.	
ESIIS26580		Categorical Homotopy Theory	2	2	1~3	Fall	An introductory course on closed model categories.	
ESIIS25560		Advanced Number Theory	2	2	1~3	Spring	Lectures on Number Theory, especially prime numbers, Fermat's theorem and Gaussian reciprocity law.	
ESIIS26590		Advanced Complex Analysis	2	2	1~3	Fall	After reviewing Cauchy's integral theorem and residue theorem in complex function theory, we give an overview on the theory of special functions.	
ESIIS25570		Advanced Electronic Properties of Molecular Solids	2	2	1~3	Spring	I focus on advanced electronic structure methods for properties of organic solids: from density functional theory to many-body electronic structure theory.	
ESIIS25580		Advanced Physics of Complex Systems	2	2	1~3	Spring	Lecture in theoretical methods in mathematical physics for studying complex systems.	
ESIIS25590		Advanced Wireless Communication Engineering	2	2	1~3	Spring	This lecture provides a theoretical foundation for understanding wireless communication systems. Students will learn how to model and formulate these systems using probability theory and statistics, and will gain practical experience in evaluating their performance.	
ESIIS25600		Advanced Mechanical Control Engineering	2	2	1~3	Spring	This lecture provides the basic theory and its application for intelligence of mechanical control devices using evolutionary computation algorithms, and will deepen the discussion based on the latest research results.	

Requirements for course completion:

Students must obtain 12 or more credits including 6 credits of required subjects (Dissertation I on Interdisciplinary Intelligent Systems Engineering and Dissertation II on Interdisciplinary Intelligent Systems Engineering).

In addition to receiving the necessary instruction, students must also receive a passing grade on final examinations and Doctoral dissertation.

Table (Article 10) Doctoral Program

Course: Marine and Environmental Sciences

FIELD	SUBJECT		Subject Code	SUBJECT	CREDITS	HOURS	YEARS	SEMESTERS	SUBJECT DESCRIPTION
BIOSCIENCE/ ENVIRONMENTAL SCIENCE	REQUIRED	COMMON	ESME25010	Advanced Special Seminar	2	30	1-3	Fall/ Spring	In seminar format. Through the introduction of original academic papers, as well as presentation and discussions related to research activities in science, students learn advanced academic communication, critical thinking, and issue-solving skills.
			ESME25020	Advanced Special Exercise	2	60	1-3	Fall/ Spring	Students learn about basic principles of science, as well as advanced professional knowledge and skills, formulation of advanced research plans, advanced information searching and data analytical skills, organization, and drawing scientifically-based conclusions.
BIOSCIENCE	ELECTIVE	SPECIAL	ESME25240	Fish and Shellfish Molecular Population Genetics	2	30	1-3	Fall	Genetic species identification of fish and shellfish, existence of cryptic species, exploration of genetic markers for stock identification, study method for aquatic organisms will be presented and discussed. How to write dissertation will be instructed.
			ESME25210	Cephalopod Behavior	2	30	1-3	Fall	Various aspects of behavioral characteristics in cephalopods. These include learning, memory, sociality, and reproductive behavior in octopus, squid and cuttlefish. This class tries to learn how intelligent these creatures (cephalopods) are.
			ESME25220	Reproductive Physiology	2	30	1-3	Spring	Physiological and behavioral mechanisms of reproductive events in low vertebrates. Special attention is paid to endocrine regulation of respective function.
			ESME25140	Plant Molecular Phylogeny	2	30	1-3	Spring	Discussion of current topics in molecular phylogeny and evolution of vascular plants.
			ESME25150	Plant Molecular Biology	2	30	1-3	Fall	Current topics in molecular genetics, genome science, genetic engineering, and bioimaging techniques, mainly focusing on plants.
			ESME25120	Oxygen Biology	2	30	1-3	Fall	Comprehensive review on biochemistry and biology of reactive oxygen (ROS) and nitrogen species (RNS).
			ESME25130	Microscopic Structures of Body Surfaces and Their Functions	2	30	1-3	Fall	Microscopic structures of the body surface of marine invertebrates and the approaches to reveal their properties and functions.
			ESME25160	Developmental Physiology	2	30	1-3	Spring	Molecular and cellular aspects of mammalian and insect developmental systems.
			ESME25360	Species Biology	2	30	1-3	Fall	Discussion and presentation about the definition, identification and characteristics of "species".
			ESME25370	Evolutionary Biology of Tropical Organisms	2	30	1-3	Fall	Discussion about evolutionary mechanisms that create biodiversity in the tropics.
			ESME25180	Organelles and Cell Physiology	2	30	1-3	Spring	Topics in physiological aspects of organelle dynamics and function. Focuses on organelle-related diseases, aging, and cell differentiation.
			ESME25190	Vertebrate Systematics and Evolutionary Biology	2	30	1-3	Fall	Discussion and presentation about evolution and divergence processes in vertebrates.
			ESME25390	Molecular Enzymology of Plant Degradation	2	30	1-3	Fall	Reviews on the recent advances on molecular machinery and classifications of enzymes involved in biodegradation of plant cell walls.
			ESME25170	Evolutionary Anthropology	2	30	1-3	Spring	Review of evolutionary histories of human: genetics, extant primates, fossils, culture, and society.
			ESME25380	Ecology of Tropical Coasts	2	30	1-3	Fall	Review on current topics of tropical coastal ecology, particularly coral reefs and discussion on environmental issues.
			ESME25350	Advanced Seminar of Reproductive Biology	2	30	1-3	Fall	Seminar and laboratory work on reproductive biology.
			ESME25460	Biodiversity Study	2	30	1-3	Spring	The term biodiversity refers to a concept that indicates diversities related to living organisms on earth. This class will debate about selected biodiversity-related research and reviews.
			ESME25320	Advanced Marine Environmental Biology	2	30	1-3	Fall	Review, presentation and discussion of current topics related to marine environment including climate change effects on marine organisms and ecosystems.
			ESME25400	Plant Reproductive Ecology	2	30	1-3	Fall	Review on recent progress of plant reproductive biology, including the basics of gender expression, pollination and phenology.
			ESME25470	Global Change Biology	2	30	1-3	Spring	Introduction of current topics about the response of corals to global warming.
			ESME25490	Advanced Methodology for Field Ecology	2	30	1-3	Fall	Students will learn statistical sampling techniques to detect patterns in biological communities in the field. The primary audience will be those who already have experience of field surveys.

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Course: Marine and Environmental Sciences

Bachelor of Science in Environmental Science									
FIELD	SUBJECT		Subject Code	SUBJECT	CREDITS	HOURS	YEARS	SEMESTERS	SUBJECT DESCRIPTION
		COMMON	ESME25250	Advanced Ecology	2	30	1-3	Fall	Review of current topics on the maintenance and origin of biodiversity patterns based on taxonomic, functional and phylogenetic properties.
			ESME25270	Advanced Ecology of Coral Reef Organisms	2	30	1-3	Fall	Review, presentation and discussion about coral reef organisms and related research fields.
			ESME21020	Advanced Environmental Chemistry	2	30	1-3	Spring	This course provides an overview of chemical reactions occurring in aquatic environment. In particular, this course deals with photochemical reactions caused by sunlight.
			ESME23010	Carbonate Geochemistry	2	30	1-3	Spring	This course deals with carbonates in lithosphere and hydrosphere, especially natural mechanism of CO ₂ absorption from atmosphere in the global carbon cycles and its role in coral reefs.
			ESME25330	Advanced Asymmetric Organic Reaction	2	30	1-3	Fall	This lecture will be about synthetic strategies for asymmetric organic reactions including catalysis.
			ESME25110	Advanced Marine Environmental Chemistry	2	30	1-3	Fall & Spring	Chemical processes in marine environments.
			ESME25300	Spectrometric Analysis of Organic Compounds	2	30	1-3	Fall	Spectroscopic methods for structure analysis such as mass spectrometry, nuclear magnetic resonance spectroscopy and infrared spectroscopy.
			ESME25070	Advanced Ocean Wave Remote Sensing	2	30	1-3	Fall & Spring	Physics of ocean surface waves, principle of ocean wave remote sensing and application of ocean wave remote sensing to physical oceanography.
			ESME25510	Advanced Numerical Weather Prediction	2	30	1-3	Fall	Acquire knowledge of numerical weather prediction and its applications through series of lectures and seminars.
			ESME25040	Igneous Petrology and Geochemistry	2	30	1-3	Fall & Spring	Reviews and discussion about trace elements and isotopic composition of environmental Earth materials.
			ESME25050	Geodynamics	2	30	1-3	Fall	This course deals with mechanics of deformation of the crust and mantle. Geological areas of application include earthquakes and tsunamis, tectonic plate flexure, and upper mantle flow and deformation.
			ESME25060	Crustal Evolution	2	30	1-3	Fall	This lecture unit introduces the recent results of the crustal evolution process from the point of view of petrogenesis of metamorphic rock and its geochronology.
			ESME25230	Advanced Biodiversity of Marine Invertebrates	2	30	1-3	Spring	Discussion of marine biodiversity, historical and modern problems in its estimation, and varying concepts of species and methodologies to detect and count them.
			ESME25480	International Field Course	2	30	1-3	Spring	Field and laboratory work at field stations to learn techniques of marine and environmental sciences related to LA MER program.
		ESME25500	Advanced Cross-Disciplinary Seminar	2	30	1-3	Fall	Students will learn how to plan, organize, manage, open, and run a small conference.	
		COMMON	ESME25420	Special Lecture A	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25430	Special Lecture B	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25440	Special Lecture C	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25450	Special Lecture D	2	30	1-3	Intensive	Course on marine and environmental sciences.

Requirements for course completion:

Students must obtain a total of 12 or more credits including 2 credits from Advanced Special Seminar and 2 credits from Advanced Special Exercise. In addition to receiving the necessary instruction, the student must also receive a passing grade on final examinations and Doctoral dissertation.

Table (Article 10) Doctoral Program

Course: Marine and Environmental Sciences

FIELD	SUBJECT		Subject Code	SUBJECT	CREDITS	HOURS	YEARS	SEMESTERS	SUBJECT DESCRIPTION
BIOSCIENCE/ ENVIRONMENTAL SCIENCE	REQUIRED	COMMON	ESME25010	Advanced Special Seminar	2	30	1-3	Fall/ Spring	In seminar format. Through the introduction of original academic papers, as well as presentation and discussions related to research activities in science, students learn advanced academic communication, critical thinking, and issue-solving skills.
			ESME25020	Advanced Special Exercise	2	60	1-3	Fall/ Spring	Students learn about basic principles of science, as well as advanced professional knowledge and skills, formulation of advanced research plans, advanced information searching and data analytical skills, organization, and drawing scientifically-based conclusions.
BIOSCIENCE	ELECTIVE	SPECIAL	ESME25240	Fish and Shellfish Molecular Population Genetics	2	30	1-3	Fall	Genetic species identification of fish and shellfish, existence of cryptic species, exploration of genetic markers for stock identification, study method for aquatic organisms will be presented and discussed. How to write dissertation will be instructed.
			ESME25210	Cephalopod Behavior	2	30	1-3	Fall	Various aspects of behavioral characteristics in cephalopods. These include learning, memory, sociality, and reproductive behavior in octopus, squid and cuttlefish. This class tries to learn how intelligent these creatures (cephalopods) are.
			ESME25220	Reproductive Physiology	2	30	1-3	Spring	Physiological and behavioral mechanisms of reproductive events in low vertebrates. Special attention is paid to endocrine regulation of respective function.
			ESME25140	Plant Molecular Phylogeny	2	30	1-3	Spring	Discussion of current topics in molecular phylogeny and evolution of vascular plants.
			ESME25150	Plant Molecular Biology	2	30	1-3	Fall	Current topics in molecular genetics, genome science, genetic engineering, and bioimaging techniques, mainly focusing on plants.
			ESME25120	Oxygen Biology	2	30	1-3	Fall	Comprehensive review on biochemistry and biology of reactive oxygen (ROS) and nitrogen species (RNS).
			ESME25130	Microscopic Structures of Body Surfaces and Their Functions	2	30	1-3	Fall	Microscopic structures of the body surface of marine invertebrates and the approaches to reveal their properties and functions.
			ESME25160	Developmental Physiology	2	30	1-3	Spring	Molecular and cellular aspects of mammalian and insect developmental systems.
			ESME25360	Species Biology	2	30	1-3	Fall	Discussion and presentation about the definition, identification and characteristics of "species".
			ESME25370	Evolutionary Biology of Tropical Organisms	2	30	1-3	Fall	Discussion about evolutionary mechanisms that create biodiversity in the tropics.
			ESME25180	Organelles and Cell Physiology	2	30	1-3	Spring	Topics in physiological aspects of organelle dynamics and function. Focuses on organelle-related diseases, aging, and cell differentiation.
			ESME25190	Vertebrate Systematics and Evolutionary Biology	2	30	1-3	Fall	Discussion and presentation about evolution and divergence processes in vertebrates.
			ESME25390	Molecular Enzymology of Plant Degradation	2	30	1-3	Fall	Reviews on the recent advances on molecular machinery and classifications of enzymes involved in biodegradation of plant cell walls.
			ESME25170	Evolutionary Anthropology	2	30	1-3	Spring	Review of evolutionary histories of human: genetics, extant primates, fossils, culture, and society.
			ESME25380	Ecology of Tropical Coasts	2	30	1-3	Fall	Review on current topics of tropical coastal ecology, particularly coral reefs and discussion on environmental issues.
			ESME25350	Advanced Seminar of Reproductive Biology	2	30	1-3	Fall	Seminar and laboratory work on reproductive biology.
			ESME25460	Biodiversity Study	2	30	1-3	Spring	The term biodiversity refers to a concept that indicates diversities related to living organisms on earth. This class will debate about selected biodiversity-related research and reviews.
			ESME25320	Advanced Marine Environmental Biology	2	30	1-3	Fall	Review, presentation and discussion of current topics related to marine environment including climate change effects on marine organisms and ecosystems.
			ESME25400	Plant Reproductive Ecology	2	30	1-3	Fall	Review on recent progress of plant reproductive biology, including the basics of gender expression, pollination and phenology.
			ESME25470	Global Change Biology	2	30	1-3	Spring	Introduction of current topics about the response of corals to global warming.
			ESME25490	Advanced Methodology for Field Ecology	2	30	1-3	Fall	Students will learn statistical sampling techniques to detect patterns in biological communities in the field. The primary audience will be those who already have experience of field surveys.

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Course: Marine and Environmental Sciences

FIELD	SUBJECT	Subject Code	SUBJECT	CREDITS	HOURS	YEARS	SEMESTERS	SUBJECT DESCRIPTION	
		COMMON	ESME25250	Advanced Ecology	2	30	1-3	Fall	Review of current topics on the maintenance and origin of biodiversity patterns based on taxonomic, functional and phylogenetic properties.
			ESME25270	Advanced Ecology of Coral Reef Organisms	2	30	1-3	Fall	Review, presentation and discussion about coral reef organisms and related research fields.
			ESME21020	Advanced Environmental Chemistry	2	30	1-3	Spring	This course provides an overview of chemical reactions occurring in aquatic environment. In particular, this course deals with photochemical reactions caused by sunlight.
			ESME23010	Carbonate Geochemistry	2	30	1-3	Spring	This course deals with carbonates in lithosphere and hydrosphere, especially natural mechanism of CO ₂ absorption from atmosphere in the global carbon cycles and its role in coral reefs.
			ESME25330	Advanced Asymmetric Organic Reaction	2	30	1-3	Fall	This lecture will be about synthetic strategies for asymmetric organic reactions including catalysis.
			ESME25110	Advanced Marine Environmental Chemistry	2	30	1-3	Fall & Spring	Chemical processes in marine environments.
			ESME25300	Spectrometric Analysis of Organic Compounds	2	30	1-3	Fall	Spectroscopic methods for structure analysis such as mass spectrometry, nuclear magnetic resonance spectroscopy and infrared spectroscopy.
			ESME25070	Advanced Ocean Wave Remote Sensing	2	30	1-3	Fall & Spring	Physics of ocean surface waves, principle of ocean wave remote sensing and application of ocean wave remote sensing to physical oceanography.
			ESME25510	Advanced Numerical Weather Prediction	2	30	1-3	Fall	Acquire knowledge of numerical weather prediction and its applications through series of lectures and seminars.
			ESME25040	Igneous Petrology and Geochemistry	2	30	1-3	Fall & Spring	Reviews and discussion about trace elements and isotopic composition of environmental Earth materials.
			ESME25050	Geodynamics	2	30	1-3	Fall	This course deals with mechanics of deformation of the crust and mantle. Geological areas of application include earthquakes and tsunamis, tectonic plate flexure, and upper mantle flow and deformation.
			ESME25060	Crustal Evolution	2	30	1-3	Fall	This lecture unit introduces the recent results of the crustal evolution process from the point of view of petrogenesis of metamorphic rock and its geochronology.
			ESME25230	Advanced Biodiversity of Marine Invertebrates	2	30	1-3	Spring	Discussion of marine biodiversity, historical and modern problems in its estimation, and varying concepts of species and methodologies to detect and count them.
			ESME25480	International Field Course	2	30	1-3	Spring	Field and laboratory work at field stations to learn techniques of marine and environmental sciences related to G-OCEANS program.
			ESME25500	Advanced Cross-Disciplinary Seminar	2	30	1-3	Fall	Students will learn how to plan, organize, manage, open, and run a small conference.
			ESME25420	Special Lecture A	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25430	Special Lecture B	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25440	Special Lecture C	2	30	1-3	Intensive	Course on marine and environmental sciences.
			ESME25450	Special Lecture D	2	30	1-3	Intensive	Course on marine and environmental sciences.

Requirements for course completion:

Students must obtain a total of 12 or more credits including 2 credits from Advanced Special Seminar and 2 credits from Advanced Special Exercise. In addition to receiving the necessary instruction, the student must also receive a passing grade on final examinations and Doctoral dissertation.