

# **Graduate Major in Energy Science and Engineering**

## **【Master's Degree Program】**

### **1. Outline**

This degree program takes a holistic approach to graduate education in the Interdisciplinary field of Energy Science and Engineering. It aims to develop energy science and engineering leaders of the future who can solve complex problems using technology, science and engineering.

The Master's Degree Program, for Graduate Major in Energy Science and Engineering teaches students highly technical knowledge based on fundamental disciplines such as physics, chemistry, materials, machinery, and electricity. In addition, this major provides students various skills for evaluating diverse energy-related issues from the viewpoint of multidisciplinary energy sciences, fact-finding, problem solving, and global leadership, which are necessary for innovation in a sustainable society.

### **2. Competencies Developed**

The students will acquire,

- Highly technical knowledge in one of the energy field disciplines (i.e., physics, chemistry, materials science, mechanical engineering, energy based economics and electrical engineering)
- Fundamental technical knowledge in order to understand diverse energy-related topics
- Practical problem-solving skills based on technical knowledge in the energy field
- Ability to work proactively and investigate new energy research related themes
- Ability to find new directions on energy topics by diverse thinking
- Global technical communication skills

### **3. Learning Goals**

The students enrolled in energy science and engineering will learn,

A) Fundamental knowledge in the field of energy science and engineering

A wide variety of energy related coursework will provide students with fundamental knowledge and allow skills development in energy-related disciplines such as physics, chemistry, materials science, mechanical engineering, energy based economics and electrical engineering.

B) Advanced knowledge in the field of energy science and engineering

A wide variety of coursework will provide students an advanced knowledge and skills about energy-related disciplines such as physics, chemistry, materials science, mechanical engineering, energy based economics and electrical engineering.

C) Interdisciplinary view in energy field and problem-solving training

By engaging in original research focused on addressing specific challenges and completing a Master's thesis, students learn to gain an overview of multidisciplinary energy sciences, identify key issues, and solve problems.

D) Understanding ethics and safety

Appreciation of the societal responsibilities as researchers and knowledge on safety concerning technology, research and development as well as ethical practices.

E) Communication Skills

Technical communication skills are developed by both domestic and international collaboration, and by acquiring the ability to evaluate research and anticipate new applications from a global point of view.

#### 4. IGP Completion Requirements

The following requirements must be met to complete the Master's Degree Program of this major.

1. Attain a total of 30 credits or more from 400- and 500-level courses.
2. From the courses specified in the Graduate Major in Energy Science and Engineering curriculum below,
  - a minimum of 25 credits acquired from major courses and research seminars
  - a minimum of 4 credits from “Interdisciplinary Scientific Principles of Energy Courses” and a minimum of 4 credits from the major courses in the department in which the student was admitted. For students in the Department of Chemistry, a minimum of 4 credits from the Chemistry Major Courses (\*), and for students in the Department of Transdisciplinary Science and Engineering, a minimum of 4 credits from energy major courses in other departments (either one or more) that offer Graduate Major in Energy Science and Engineering.
  - 8 credits acquired from “Research Seminars” (Seminar in energy science Spring quarters in the 1st year (S1), Fall quarters 1st year (F1), Spring 2nd Year (S2), and Fall 2nd Year (F2)); and
  - A minimum of 5 credits acquired from Liberal Arts and Basic Science Courses (3 credits from Humanities and Social Science Courses of which 2 credits must be from 400-level courses and 1 credit from 500-level courses, and 2 credits from Career Development Courses).
3. Pass the master's thesis exam and oral defense.

Table M1 shows course categories and the number of credits required to complete the Master's Degree Program in this major. It also shows the required minimum credits in each course category and points to be noted when selecting the required courses and electives.

The learning goals to be obtained by students through courses are listed as “associated learning objectives”. Prior to registering courses, students need to fully understand the course goals.

**Table M1. Graduate Major in Energy Science and Engineering Completion Requirements**

Course category		<Required courses> Required credits	<Electives> Minimum credits required	Minimum credits required	Associated learning goals	Comments
Liberal arts and basic science courses	Humanities and social science courses		2 credits from 400-level 1 credit from 500-level	5 credits	D	
	Career development courses		2 credits from 400- and 500-levels		C,D,E	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core courses	Research seminars	Seminar in Energy Science S1 Seminar in Energy Science F1 Seminar in Energy Science S2 Seminar in Energy Science F2 A total of 8 credits, 2 credits each from above courses.		25 credits	B,C,D,E	
	Research-related courses				B,C,D,E	
	Major courses		a minimum of 4 credits from “Interdisciplinary Scientific Principles of Energy Courses” and a minimum of 4 credits from the Major Courses in the student’s department.  For students in Department of Chemistry, a minimum of 4 credits from the Chemistry major courses (*), and for students in the Department of Transdisciplinary Science and Engineering, a minimum of 4 credits from energy major courses in other departments (either one or more) that offer Graduate		A,B	

			Major in Energy Science and Engineering.			
	<b>Major courses and Research-related Courses outside the Graduate Major in Energy Science Engineering standard curriculum</b>					
<b>Total required credits</b>	<b>A minimum of 30 credits including those attained according to the above conditions</b>					
<b>Note</b>	<ul style="list-style-type: none"> <li>• Japanese Language and Culture Courses offered to international students can be recognized as equivalent to the Humanities and Social Science Courses of the corresponding course level.</li> <li>• For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.</li> <li>• For students in the Department of Chemistry, a minimum of 4 credits must come from the Chemistry Course Track marked with ‘(*)’.</li> </ul>					

## 5. IGP Courses

Table M2 shows the Core Courses of the Master's Degree Program in this major. Graduate Majors listed in the Comments column offer core courses that are recognized as equivalent to the corresponding Major Courses or Research-related Courses in the standard curriculum of this major.

**Table M2. Core Courses of the Graduate Major in Energy Science and Engineering**

Course category	Course number	Course title		Credits	Competencies	Learning goals	Comments	
Research seminars	400 level	ENR.Z491.R	☉	Seminar in energy science S1	0-0-2	1,3,4,5	A,B,C	
		ENR.Z492.R	☉	Seminar in energy science F1	0-0-2	1,3,4,5	A,B,C	
	500 level	ENR.Z591.R	☉	Seminar in energy science S2	0-0-2	1,3,4,5	A,B,C	
		ENR.Z592.R	☉	Seminar in energy science F2	0-0-2	1,3,4,5	A,B,C	
Research-related courses	400 level	ENR.E491.L	<input type="checkbox"/>	Environment Preservation and Chemical Safety I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.E401) Chemical Science and Engineering Course Track
		ENR.E492.L	<input type="checkbox"/>	Environment Preservation and Chemical Safety II	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.E402) Chemical Science and Engineering Course Track
		ENR.E493.L		Advanced Internship in Chemical Science and Engineering I	0-0-1	2,3,5	B,D	【Chemical Science and Engineering】 (CAP.E411) Chemical Science and Engineering Course Track (for students affiliated with the Department of Chemical Science and Engineering only)
		ENR.E494.L		Advanced Internship in Chemical Science and Engineering II	0-0-2	2,3,5	B,D	【Chemical Science and Engineering】 (CAP.E412) Chemical Science

							and Engineering Course Track (for students affiliated with the Department of Chemical Science and Engineering only)
	ENR.E495.L	<input type="checkbox"/>	Presentation Practice	0-1-0	3,5	E or B,D	【Chemical Science and Engineering】 (CAP.E422) Chemical Science and Engineering Course Track (for students affiliated with the Department of Chemical Science and Engineering only)
<b>500 level</b>	ENR.B502.L		Energy innovation co-creative project	0-0-1	1,2,3,4,5	A,C,E	
	ENR.B503		Energy Engineering Internship A	0-0-1	2,3,5	C,D,E	Course outside the standard curriculum
	ENR.B504		Energy Engineering Internship B	0-0-2	2,3,5	C,D,E	Course outside the standard curriculum
	ENR.H591.L	<input type="checkbox"/>	Scientific Ethics	1-0-0	1,5	D or B,D	【Chemical Science and Engineering】 (CAP.E521) Chemical Science and Engineering Course Track (for students affiliated with the Department of Chemical Science and Engineering only)
	ENR.B511.L	★	Energy Off-Campus Project S A	0-0-1	1,5	B,C,E	
	ENR.B512.L	★	Energy Off-Campus Project S B	0-0-1	1,5	B,C,E	
	ENR.B513.L	★	Energy Off-Campus Project S C	0-0-1	1,5	B,C,E	
	ENR.B514.L	★	Energy Off-Campus Project S D	0-0-1	1,5	B,C,E	
	ENR.B515.L	★	Energy Off-Campus Project L A	0-0-2	1,3,5	B,C,E	

		ENR.B516.L	★	Energy Off-Campus Project L B	0-0-2	1,3,5	B,C,E		
		ENR.B517.L	★	Energy Off-Campus Project L C	0-0-2	1,3,5	B,C,E		
		ENR.B518.L	★	Energy Off-Campus Project L D	0-0-2	1,3,5	B,C,E		
		ENR.B519.L	★	Energy International Workshop A	0-0-1	1,3	C,E		
		ENR.B520.L	★	Energy International Workshop B	0-0-1	1,3	C,E		
		ENR.B521.L	★	Energy International Workshop C	0-0-1	1,3	C,E		
		ENR.B522.L	★	Energy International Workshop D	0-0-1	1,3	C,E		
		<b>Interdisciplinary Principles of Energy Courses 400 Level</b>							
Major courses	<b>400 level</b>	ENR.A401.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary scientific principles of energy 1	1-0-0	1,4,5	A,C	
		ENR.A402.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary scientific principles of energy 2	1-0-0	1,4,5	A,C	
		ENR.A403.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary principles of energy devices 1	1-0-0	1,5	A,C	
		ENR.A404.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary principles of energy devices 2	1-0-0	1,4,5	A,C	
		ENR.A405.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary Energy Materials Science 1	1-0-0	1,4,5	A,C	
		ENR.A406.A	<input type="radio"/>	★ <input type="checkbox"/>	Interdisciplinary Energy Materials Science 2	1-0-0	1,4,5	A,C	
		ENR.A407.A	<input type="radio"/>	★ <input type="checkbox"/>	Energy system theory	1-0-0	1,4	A,C	
		ENR.A408.A	<input type="radio"/>	★ <input type="checkbox"/>	Economy of energy system	1-0-0	1,4,5	A,C	
		ENR.B430.L	<input type="checkbox"/>		Advanced Science and Technology in Energy and Environment	2-0-0	1,5	A,C	
		ENR.B431.L	<input type="checkbox"/>	★ <input type="checkbox"/>	Recent technologies of fuel cells, solar cells, batteries and energy system	1-0-0	1,2,3,4,5	A,C	Open also to Tokyo Tech Summer Program participants
		ENR.B432.L	<input type="checkbox"/>	★ <input type="checkbox"/>	Technologies for Energy and Resource Utilization	1-0-0	1,2,3	A,C,D	【Global Engineering for Development, Environment and Society】 (GEG.E404)
		ENR.B433.L	<input type="checkbox"/>	★	Project Design & Management S	0-1-1	2,3,5	B,C,E	【Global

							Engineering for Development, Environment and Society】 (GEG.P451)
ENR.B434.L		★	Project Design & Management F	0-1-1	2,3,4,5	B,C,E	【Global Engineering for Development, Environment and Society】 (GEG.P452)
ENR.B435.L		★ □	The economics and systems analysis of environment, resources and technology	1-0-0	1,4,5	A,B	【Global Engineering for Development, Environment and Society】 (GEG.S402)
ENR.B436.L		□	Special lecture of economics and politics in energy	1-0-0	1,4,5	A,C	
ENR.B437.L		★	Energy & Environment-1	1-0-0	1,5	A,B,E	【Global Engineering for Development, Environment and Society】 (GEG.E421) Open also to Tokyo Tech Summer Program participants
ENR.B438.L		★	Materials simulation	2-0-0	1,5	B	【Tokyo Tech Academy for Convergence of Materials and Informatics】 (TCM.A402)
ENR.B440.L		★	Materials Informatics	2-0-0	1,5	B	【Tokyo Tech Academy for Convergence of Materials and Informatics】 (TCM.A404)
Chemistry Course Track 400 Level							
ENR.I401.L		★ □	(*)Basic Concepts of Inorganic Chemistry	2-0-0	1	A	【Chemistry】 (CHM.B401)



ENR.I402.L	<input checked="" type="checkbox"/>	(*)Basic Concepts of Physical Chemistry	2-0-0	1	A	【Chemistry】 (CHM.C401)
ENR.I403.L	<input checked="" type="checkbox"/>	(*)Basic Concepts of Organic Chemistry	2-0-0	1	A	【Chemistry】 (CHM.D401)
ENR.I410.L	<input checked="" type="checkbox"/>	Optical properties of solids	2-0-0	1,4	B	
ENR.I420.L	<input checked="" type="checkbox"/>	Advanced Lecture on Crystal Structure and Correlation with Properties of Solids	1-0-0	1,5	B	
ENR.I422.L	<input type="checkbox"/>	Global Environmental Chemistry	2-0-0	1	B	【Chemistry】 (CHM.B435)
ENR.I423.L	<input checked="" type="checkbox"/>	Advanced Physical Chemistry	2-0-0	1	B	【Chemistry】 (CHM.C431)
ENR.I424.L	<input checked="" type="checkbox"/>	Advanced Quantum Chemistry	2-0-0	1	B	【Chemistry】 (CHM.C432)
ENR.I425.L	<input checked="" type="checkbox"/>	Advanced Organic Synthesis	2-0-0	1,5	B	【Chemistry】 (CHM.D432)
ENR.I426.L	<input checked="" type="checkbox"/>	Advanced Organometallic Chemistry	2-0-0	1	B	【Chemistry】 (CHM.D433)
ENR.I427.L	<input checked="" type="checkbox"/>	Photochemical Reactions I	1-0-0	1	B	【Chemistry】 (CHM.B436)
ENR.I428.L	<input checked="" type="checkbox"/>	Photochemical Reactions II	1-0-0	1	B	【Chemistry】 (CHM.B437)
ENR.I431.L		Laboratory Training of Synchrotron Radiation Science	0-0-1	1,5	B,D	【Chemistry】 (CHM.A431)
ENR.I435.L	<input checked="" type="checkbox"/>	Current Chemistry I	1-0-0	1,2,3	B,D	【Chemistry】 (CHM.A435)
ENR.I436.L	<input checked="" type="checkbox"/>	Current Chemistry II	1-0-0	1,2,3	B	【Chemistry】 (CHM.A436)
ENR.I437.L	<input checked="" type="checkbox"/>	Current Chemistry III	1-0-0	1,2,3	B	【Chemistry】 (CHM.A437)
ENR.I438.L	<input checked="" type="checkbox"/>	Current Chemistry IV	1-0-0	1,2,3	B	【Chemistry】 (CHM.A438)
ENR.I441.L	<input checked="" type="checkbox"/>	Advanced Separation Science	2-0-0	1,5	B	【Chemistry】 (CHM.B431)
ENR.I442.L	<input checked="" type="checkbox"/>	Catalytic Chemistry on Solid Surface	2-0-0	1	B	【Chemistry】 (CHM.B433)
ENR.I443.L	<input checked="" type="checkbox"/>	Advanced Course in Crystal Structure Science	2-0-0	1	B	【Chemistry】 (CHM.B434)
ENR.I444.L	<input checked="" type="checkbox"/>	Advanced Bioorganic Chemistry	2-0-0	1	B	【Chemistry】 (CHM.D431)
ENR.I461.L		Recent Progress in Chemistry I	1-0-0	1	B	【Chemistry】 (CHM.) A441 Only for even

							academic years
ENR.I462.L			Recent Progress in Chemistry II	1-0-0	1	B	【Chemistry】 (CHM.) A442 Only for even academic years
ENR.I463.L			Recent Progress in Chemistry III	1-0-0	1	B	【Chemistry】 (CHM.) A443 Only for even academic years
ENR.I464.L			Recent Progress in Chemistry IV	1-0-0	1	B	【Chemistry】 (CHM.) A444 Only for even academic years
ENR.I465.L			Recent Progress in Chemistry V	1-0-0	1	B	【Chemistry】 (CHM.) A445 Only for even academic years
ENR.I466.L			Recent Progress in Chemistry VI	1-0-0	1	B	【Chemistry】 (CHM.) A446 Only for even academic years
ENR.I467.L			Recent Progress in Chemistry VII	1-0-0	1	B	【Chemistry】 (CHM.) A447 Only for odd academic years
ENR.I468.L			Recent Progress in Chemistry VIII	1-0-0	1	B	【Chemistry】 (CHM.) A448 Only for odd academic years
ENR.I469.L			Recent Progress in Chemistry IX	1-0-0	1	B	【Chemistry】 (CHM.) A449 Only for odd academic years
ENR.I470.L			Recent Progress in Chemistry X	1-0-0	1	B	【Chemistry】 (CHM.) A450 Only for odd academic years
ENR.I471.L			Recent Progress in Chemistry XI	1-0-0	1	B	【Chemistry】 (CHM.) A451 Only for odd academic years
ENR.I472.L			Recent Progress in Chemistry XII	1-0-0	1	B	【Chemistry】 (CHM.) A452 Only for odd

							academic years
Mechanical Engineering Course Track 400 Level							
ENR.K401.L		★	Mechanics of Composite Materials	1-0-0	1	A	【Mechanical Engineering】 (MEC.C431)
ENR.K402.L		★	Solid Dynamics	1-0-0	1,5	A	【Mechanical Engineering】 (MEC.C433)
ENR.K411.L		★ □	Advanced Sound and Vibration Measurement	1-0-0	1	A	【Mechanical Engineering】 (MEC.D431)
ENR.K412.L		★ □	Thermodynamics of Nonequilibrium Systems	1-0-0	1	A	【Mechanical Engineering】 (MEC.E431)
ENR.K413.L		★ □	Properties of Solid Materials	1-0-0	1	A	【Mechanical Engineering】 (MEC.E432)
ENR.K414.L		★ □	Advanced Thermal-Fluids Measurement	1-0-0	1,5	A	【Mechanical Engineering】 (MEC.E433)
ENR.K421.L		★ □	Computational Thermo-Fluid Dynamics	1-0-0	1	A	【Mechanical Engineering】 (MEC.F431)
ENR.K422.L		★	Mechanical Processing	1-0-0	1	A	【Mechanical Engineering】 (MEC.G431)
ENR.K430.L		★ □	Advanced course of turbulent flow and control	1-0-0	1,5	A	
ENR.K431.L		★	Metalforming	1-0-0	1	A	【Mechanical Engineering】 (MEC.G432)
ENR.K440.L		★ □	Advanced course of radiation transfer	1-0-0	1,5	A	
ENR.K441.L		★	Advanced Mechanical Elements	1-0-0	1,5	A	【Mechanical Engineering】 (MEC.H431)
ENR.K450.L		★ □	Advanced course of combustion physics	1-0-0	1,5	A	
ENR.K461.L		★	Mechatronics Device and Control	1-0-0	1,3	A	【Mechanical Engineering】 (MEC.H433)
ENR.K462.L		★ □	Advanced Course of Actuator Engineering	1-0-0	1,5	A	【Mechanical Engineering】 (MEC.H434)

ENR.K471.L	<input type="checkbox"/>	★	Ultra-precision Measurement	1-0-0	1	A	【Mechanical Engineering】 (MEC.J431)
ENR.K472.L	<input type="checkbox"/>	★	Mechanism and Control for Ultra-precision Motion	1-0-0	1,5	A	【Mechanical Engineering】 (MEC.J432)
ENR.K492.L		★	Space Systems Analysis A	1-0-0	1	A	【Mechanical Engineering】 (MEC.M433)
ENR.K493.L			Space Systems Initiative	2-0-0	1,3,4,5	A	【Mechanical Engineering】 (MEC.M435)
Mechanical Engineering Course Track 500 Level							
ENR.K501.L		★	Mechanics of High Temperature Materials	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.C531)
ENR.K511.L		★	Experimental Modal Analysis for Structural Dynamics	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.D531)
ENR.K521.L	<input type="checkbox"/>	★	Plasma Physics	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.E531)
ENR.K530.L	<input type="checkbox"/>	★	Advanced course of multiscale thermal-fluid sciences	1-0-0	1	B	
ENR.K531.L	<input type="checkbox"/>	★	Flying Object Engineering	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.F531)
ENR.K532.L		★	Cryogenic Engineering	1-0-0	1,4,5	B	【Mechanical Engineering】 (MEC.E532)
ENR.K561.L	<input type="checkbox"/>	★	Rarefied Gas Dynamics	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.F532)
ENR.K562.L		★	Precision Manufacturing Processes	1-0-0	1,5	B	【Mechanical Engineering】 (MEC.G531)
ENR.K572.L		★	Advanced Tribosystem	1-0-0	1	B	【Mechanical Engineering】 (MEC.J533)
ENR.K580.L	<input type="checkbox"/>	★	Leading edge energy technology	1-0-0	1,2	B	
ENR.K591.L		★	Space Systems Analysis B	1-0-0	1	B	【Mechanical Engineering】 (MEC.M531)

ENR.K592.L			Space Systems and Missions	2-0-0	1,4,5	B	【Mechanical Engineering】 (MEC.M532)
Electrical and Electronic Engineering Course Track 400 Level							
ENR.L401.L		★ <input type="checkbox"/>	Mechanical-to-electrical energy conversion	2-0-0	1,5	A	
ENR.L402.L		<input type="checkbox"/>	Utilization of Intelligent Information Resources and Patents	1-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.G401)
ENR.L404.L		★	Graph Theory with Engineering Application	1-0-0	1	A	【School of Engineering】 (XEG.S404)
ENR.L405.L		★	Topics in Digital VLSI Design	1-0-0	1	A	【School of Engineering】 (XEG.S405)
ENR.L410.L		★ <input type="checkbox"/>	Introduction to Photovoltaics	2-0-0	1,5	A	
ENR.L411.L		★ <input type="checkbox"/>	Fundamentals of Electronic Materials	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.D401)
ENR.L412.L		★ <input type="checkbox"/>	Semiconductor Physics	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.D411)
ENR.L413.L		<input type="checkbox"/>	Electrical Modeling and Simulation	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.G411)
ENR.L416.L		<input type="checkbox"/>	Advanced Electric Power Engineering	2-0-0	1,3	A	【Electrical and Electronic Engineering】 (EEE.P421)
ENR.L417.L		★ <input type="checkbox"/>	Advanced Electromagnetic Waves	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.S401)
ENR.L441.L		<input type="checkbox"/>	VLSI Technology I	2-0-0	1	A	【Electrical and Electronic Engineering】 (EEE.C441)
ENR.L442.L		★ <input type="checkbox"/>	VLSI Technology II	2-0-0	1,5	A	【Electrical and Electronic Engineering】

							Engineering】 (EEE.C442)
ENR.L443.L		★ <input type="checkbox"/>	Bipolar Transistors and Compound Semiconductor Devices	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.D451)
ENR.L444.L		<input type="checkbox"/>	Advanced Power Semiconductor Devices	2-0-0	5	A	【Electrical and Electronic Engineering】 (EEE.D481)
ENR.L445.L		★ <input type="checkbox"/>	Plasma Engineering	2-0-0	1	A	【Electrical and Electronic Engineering】 (EEE.P451)
ENR.L446.L		★ <input type="checkbox"/>	Pulsed Power Technology	2-0-0	1,4,5	A	【Electrical and Electronic Engineering】 (EEE.P461)
ENR.L447.L		★ <input type="checkbox"/>	Wireless Communication Engineering	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.S451)
ENR.L448.L		<input type="checkbox"/>	Optical Communication Systems	2-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.S461)
ENR.L449.L		★ <input type="checkbox"/>	Power electronics circuits and systems	1-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.P412)
ENR.L450.L		★ <input type="checkbox"/>	Power electronics application to power systems	1-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.P413)
ENR.L451.L		★ <input type="checkbox"/>	Power electronics control and analysis	1-0-0	1,5	A	【Electrical and Electronic Engineering】 (EEE.P414)
Electrical and Electronic Engineering Course Track 500 Level							
ENR.L501.L		★ <input type="checkbox"/>	Dielectric Property and Organic Devices	2-0-0	1	B	【Electrical and Electronic Engineering】 (EEE.D501)
ENR.L502.L		★	Magnetic Levitation and Magnetic	2-0-0	1	B	【Electrical and

		<input type="checkbox"/>	Suspension				Electronic Engineering] (EEE.P501)
ENR.L511.L		★ <input type="checkbox"/>	Magnetism and Spintronics	2-0-0	1,5	B	【Electrical and Electronic Engineering] (EEE.D511)
ENR.L530.L		★ <input type="checkbox"/>	Advanced Functional Electronic devices	2-0-0	1,2,3,4,5	B	
ENR.L550.L		★ <input type="checkbox"/>	Nano-Structure Devices	2-0-0	1,5	B	【Electrical and Electronic Engineering] (EEE.D551)
ENR.L560.L		★ <input type="checkbox"/>	Terahertz Devices and Systems	2-0-0	1,4,5	B	【Electrical and Electronic Engineering] (EEE.D561)
Materials Science and Engineering Course Track 400 Level							
ENR.J401.L		★ <input type="checkbox"/>	Advanced Metal Physics	2-0-0	1,3,5	B	
ENR.J402.L		★ <input type="checkbox"/>	Physical Chemistry for High Temperature Processes - Thermodynamics-	1-0-0	1,5	A	
ENR.J403.L		★ <input type="checkbox"/>	Physical Chemistry for High Temperature Processes -Smelting and Refining Processes-	1-0-0	1,5	B	
ENR.J404.L		★ <input type="checkbox"/>	Physical Chemistry for High Temperature Processes -Oxidation of Metals-	1-0-0	1,5	B	
ENR.J405.L		★ O <input type="checkbox"/>	Microstructure Evolution and Diffusion in Metals	2-0-0	1,4,5	B	O: English, E: Japanese
ENR.J406.L		★ <input type="checkbox"/>	Organic Electronic Materials Physics	1-0-0	1	B	
ENR.J407.L		★ <input type="checkbox"/>	Soft Materials Design	1-0-0	1,5	B	
ENR.J408.L		★ <input type="checkbox"/>	Energy Conversion Ceramics Materials	2-0-0	1	B,C	
ENR.J409.L		<input type="checkbox"/>	Introduction to Intellectual Property System	2-0-0	1,2,4,5	B,C	
ENR.J410.L		★ O <input type="checkbox"/>	Applied Diffraction Crystallography in Metals and Alloys	2-0-0	1,5	B	【Materials Science and Engineering] (MAT.M401)

							O: English, E: Japanese
ENR.J411.L		★ E <input type="checkbox"/>	Characterization of Nanomaterials	2-0-0	1	B	【Materials Science and Engineering】 (MAT.M402) a 4Q course,E,b 1 to 2 Q (class held at Tsinghua Univ.), opening English every year
ENR.J412.L		★ O <input type="checkbox"/>	Environmental Degradation of Materials	2-0-0	1	B	【Materials Science and Engineering】 (MAT.M403) O: English, E: Japanese
ENR.J446.L		★ E <input type="checkbox"/>	Transport Phenomena at High Temperature - Momentum and Heat Flow -	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.M426) O: Japanese, E: English
ENR.J447.L		★ E <input type="checkbox"/>	Transport Phenomena at High Temperature - Flow of charged particles in solid -	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.M427) O: Japanese, E: English
ENR.J414.L		★ E <input type="checkbox"/>	Advanced Microstructure Design of Ferrous Materials	2-0-0	1,2,4	B	【Materials Science and Engineering】 (MAT.M405) O: Japanese, E: English
ENR.J415.L		★ O <input type="checkbox"/>	Advanced Microstructure Design of Non-ferrous Materials	2-0-0	1,5	B	【Materials Science and Engineering】 (MAT.M406) O: English, E: Japanese
ENR.J416.L		★ O <input type="checkbox"/>	Advanced Solid State Physics	2-0-0	1,5	B	【Materials Science and Engineering】 (MAT.M407) a 3Q course,O,b 1 to 2 Q (class held at Tsinghua Univ.), opening English every yeay
ENR.J417.L		★	Quantum Statistical Mechanics	2-0-0	1,2,5	B	【Materials Science



		E <input type="checkbox"/>					and Engineering】 (MAT.M408) O: Japanese, E: English
ENR.J418.L		★ O <input type="checkbox"/>	Thermodynamics for Phase Equilibria	2-0-0	1	B	【Materials Science and Engineering】 (MAT.M409) O: English, E: Japanese
ENR.J419.L		★ O <input type="checkbox"/>	Deformation and Strength of Solids	2-0-0	1	B	【Materials Science and Engineering】 (MAT.M410) O: English, E: Japanese
ENR.J448.L			Exercise in Materials Design	0-1-0	1,5	B	【Materials Science and Engineering】 (MAT.M423)
ENR.J449.L			Exercise in Physical Metallurgy	0-1-0	1,5	B	【Materials Science and Engineering】 (MAT.M424)
ENR.J450.L		★ O	Recovery, Recrystallization and Texture of Metals	1-0-0	1	B	【Materials Science and Engineering】 (MAT.M425) O: English, E: Japanese
ENR.J421.L		★ <input type="checkbox"/>	Organic Optical Materials physics	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P401)
ENR.J422.L		★ E <input type="checkbox"/>	Soft Materials Physical Chemistry	1-0-0	1	B	【Materials Science and Engineering】 (MAT.P402) O: Japanese, E: English
ENR.J423.L		★ <input type="checkbox"/>	Soft Materials Physics	1-0-0	1,2	B	【Materials Science and Engineering】 (MAT.P403)
ENR.J424.L		★ <input type="checkbox"/>	Soft Materials Functional Physics	1-0-0	1,3	B	【Materials Science and Engineering】 (MAT.P404)
ENR.J427.L		★ E <input type="checkbox"/>	Soft Materials Functional Chemistry	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P413) O: Japanese, E: English

ENR.J428.L	<input checked="" type="checkbox"/>	★	Soft Materials Function	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P414)
ENR.J429.L	<input type="checkbox"/>	★ E	Organic Materials Functional Design	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P421) O: Japanese, E: English
ENR.J430.L	<input type="checkbox"/>	★ E	Organic Materials Design	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P422) O: Japanese, E: English
ENR.J431.L	<input type="checkbox"/>	★	Advanced Course in Composite Materials	1-0-0	1	B	【Materials Science and Engineering】 (MAT.P423)
ENR.J434.L			Materials Engineering and Ecology	1-0-0	3,4,5	D	【Materials Science and Engineering】 (MAT.P491)
ENR.J435.L			Advanced Course in Organic Polymer Science	1-0-0	1	B,C	【Materials Science and Engineering】 (MAT.P492)
ENR.J437.L	<input type="checkbox"/>	★	Thermal Properties of Materials	1-0-0	1,5	B	【Materials Science and Engineering】 (MAT.P426)
ENR.J438.L	<input type="checkbox"/>		Crystals Science	2-0-0	1	B	【Materials Science and Engineering】 (MAT.C400)
ENR.J439.L	<input type="checkbox"/>		Advanced Course of Dielectric and Ferroelectric Materials	2-0-0	1,5	B	【Materials Science and Engineering】 (MAT.C401)
ENR.J440.L	<input type="checkbox"/>	★	Quantum Physics in Optical Response of Materials	2-0-0	1	B	【Materials Science and Engineering】 (MAT.C402)
ENR.J441.L	<input type="checkbox"/>		Advanced Course of Ceramic Thin Film Technology	2-0-0	1,4,5	B	【Materials Science and Engineering】 (MAT.C403)
ENR.J442.L	<input type="checkbox"/>		Physics and Chemistry of Semiconductors	2-0-0	1,2,5	B	【Materials Science and Engineering】 (MAT.C404)
ENR.J443.L	<input type="checkbox"/>		Advanced Course of Instrumental Analysis for Materials	2-0-0	1,5	B	【Materials Science and Engineering】 (MAT.C405)
ENR.J445.L		★	Nuclear Materials and Structures	2-0-0	1	B	【Nuclear

		<input type="checkbox"/>					Engineering】 (NCL.N403)
ENR.J451.L		<input type="checkbox"/>	Advanced Course of Surface Chemistry on Inorganic Materials	2-0-0	1,5	A	【Materials Science and Engineering】 (MAT.C408)
ENR.J452.L			Advanced Course of Nano-Particles Science	2-0-0	1,3,4,5	A	【Materials Science and Engineering】 (MAT.C416)
Materials Science and Engineering Course Track 500 Level							
ENR.J501.L		★ O <input type="checkbox"/>	Advanced Course of Materials Optics	2-0-0	1,5	B	【Materials Science and Engineering】 (MAT.C500) O: English, E: Japanese
ENR.J502.L		<input type="checkbox"/>	Advanced Course of Deformation and Fracture of Engineering Materials	2-0-0	1,3,4,5	B	【Materials Science and Engineering】 (MAT.C501)
ENR.J503.L		<input type="checkbox"/>	Advanced Course of Material Development I	2-0-0	1,5	B,C	【Materials Science and Engineering】 (MAT.C502)
ENR.J504.L		★ <input type="checkbox"/>	Advanced Course of Material Development II	2-0-0	1	B,C	【Materials Science and Engineering】 (MAT.C503)
ENR.J505.L		★ <input type="checkbox"/>	Functional Devices	2-0-0	1,2	B	【Materials Science and Engineering】 (MAT.C504)
ENR.J520.L		★	Fundamentals of electrochemistry and the application to energy conversion materials	1-0-0	1,2,3,4,5	B,C	【Materials Science and Engineering】 (MAT.P506)
ENR.J521.L		★	Analytical and analogical methods to solve the heat transfer equation and the application to infrared image processing	1-0-0	1,2,3,4,5	B,C	【Materials Science and Engineering】 (MAT.P507)
Chemical Science and Engineering Course Track 400 Level							
ENR.H403.L		★ <input type="checkbox"/>	Advanced Electrochemistry I	1-0-0	1	B	
ENR.H404.L		★ <input type="checkbox"/>	Advanced Electrochemistry II	1-0-0	1,5	B	
ENR.H405.L		★ <input type="checkbox"/>	Advanced Inorganic Materials Chemistry I	1-0-0	1,5	B	
ENR.H406.L		★ <input type="checkbox"/>	Advanced Inorganic Materials Chemistry II	1-0-0	1,5	B	
ENR.H410.L		★ <input type="checkbox"/>	Topics in Properties of Semiconductors	1-0-0	1,5	B	

ENR.H411.L	<input checked="" type="checkbox"/>	★ Topics in Applied Electrochemistry	1-0-0	1,5	B	
ENR.H415.L	<input type="checkbox"/>	★ Introduction to Organic Electrochemistry	1-0-0	1,5	B	
ENR.H420.L	<input type="checkbox"/>	★ Introduction to Photochemistry I	1-0-0	1,5	B	
ENR.H421.L	<input type="checkbox"/>	★ Advanced Electrochemistry I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A441)
ENR.H422.L	<input type="checkbox"/>	★ Advanced Electrochemistry II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A442)
ENR.H423.L		Advanced Instrumental Analysis	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A481)
ENR.H424.L		Scope of Chemical Science and Engineering IA	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A401)
ENR.H425.L		Scope of Chemical Science and Engineering IIA	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A402)
ENR.H428.L	<input type="checkbox"/>	★ Advanced Organic Synthesis I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A423)
ENR.H429.L	<input type="checkbox"/>	★ Advanced Organic Synthesis II	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A424)
ENR.H430.L	<input type="checkbox"/>	Introduction to Photochemistry II	1-0-0	1,4,5	B	
ENR.H431.L	<input type="checkbox"/>	★ Advanced Solid State Chemistry I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A461)
ENR.H432.L	<input type="checkbox"/>	★ Advanced Solid State Chemistry II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A462)
ENR.H433.L		★ Advanced Molecular Design of Metal Complexes I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A463)
ENR.H434.L		★ Advanced Molecular Design of Metal Complexes II	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A464)
ENR.H435.L	<input type="checkbox"/>	★ Advanced Bioinorganic Chemistry I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A465)

ENR.H436.L	<input checked="" type="checkbox"/>	Advanced Bioinorganic Chemistry II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A466)
ENR.H439.L	<input checked="" type="checkbox"/>	Advanced Solid-state Physical Chemistry I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A443)
ENR.H440.L	<input checked="" type="checkbox"/>	Advanced Solid-state Physical Chemistry II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A444)
ENR.H441.L	<input checked="" type="checkbox"/>	Advanced Polymer Synthesis I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.P411)
ENR.H443.L	<input checked="" type="checkbox"/>	Special Lecture on Characterization of Polymer Structures and Properties	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.P421)
ENR.H444.L	<input checked="" type="checkbox"/>	Advanced Polymer Properties	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.P422)
ENR.H447.L	<input type="checkbox"/>	Advanced Technology for Environmental Load Reduction I	1-0-0	1,2,5	A,C	【ACEEES】 (ACE.B441)
ENR.H448.L	<input type="checkbox"/>	Advanced Technology for Environmental Load Reduction II	1-0-0	1,2,5	A,C	【ACEEES】 (ACE.B442)
ENR.H450.L	<input checked="" type="checkbox"/>	Environmentally-Friendly Polymer Chemistry	1-0-0	1,5	B	
ENR.H451.L	<input checked="" type="checkbox"/>	Process Systems Engineering	2-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.C412)
ENR.H452.L	<input checked="" type="checkbox"/>	Advanced Energy Transfer Operation	2-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.C421)
ENR.H453.L	<input checked="" type="checkbox"/>	Advanced Chemical Reaction Engineering	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.C424)
ENR.H494.L	<input checked="" type="checkbox"/>	Advanced Bioprocess Engineering	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.C425)
ENR.H454.L	<input checked="" type="checkbox"/>	Computational Fluid Dynamics	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.C423)
ENR.H455.L	<input checked="" type="checkbox"/>	Physico-Chemical Property Analysis in Chemical Engineering	1-0-0	1,4	B	【Chemical Science and Engineering】 (CAP.C432)
ENR.H495.L	<input checked="" type="checkbox"/>	Phase Equilibrium Analysis in Chemical Engineering	1-0-0	1,4	B	【Chemical Science and Engineering】

							(CAP.C433)
ENR.H456.L		★ <input type="checkbox"/>	Transport Phenomena and Operation	2-0-0	1,2,4,5	B	【Chemical Science and Engineering】 (CAP.C441)
ENR.H458.L		★ <input type="checkbox"/>	Chemical Engineering for Advanced Materials and Chemicals Processing I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.C411)
ENR.H459.L		★ <input type="checkbox"/>	Chemical Engineering for Advanced Materials and Chemicals Processing II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.C431)
ENR.H461.L		★ <input type="checkbox"/>	Advanced Organometallic Chemistry and Catalysis I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.T431)
ENR.H462.L		★ <input type="checkbox"/>	Advanced Organometallic Chemistry and Catalysis II	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.T432)
ENR.H463.L		★ <input type="checkbox"/>	Introduction to Polymer Science	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.I426)
ENR.H464.L		★ <input type="checkbox"/>	Introduction to Polymer Physical Properties I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I436)
ENR.H465.L		★ <input type="checkbox"/>	Introduction to Polymer Chemistry	2-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.I427)
ENR.H466.L		★ <input type="checkbox"/>	Introduction to Polymer Physical Properties II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I437)
ENR.H467.L		★	Advanced Organometallic Chemistry and Catalysis	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I439)
ENR.H471.L		★ <input type="checkbox"/>	Advanced Coordination Chemistry	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I403)
ENR.H472.L		★ <input type="checkbox"/>	Environmental Chemistry	2-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.I405)
ENR.H473.L		★ <input type="checkbox"/>	Introduction to Chemical Engineering (Basics)	1-0-0	1,5	A	【Chemical Science and Engineering】 (CAP.I407)
ENR.H474.L		★ <input type="checkbox"/>	Advanced Supramolecular Science	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I420)
ENR.H475.L		★	Analytical Techniques for	1-0-0	1,5	B	【Chemical Science

		<input type="checkbox"/>	Environmental Chemistry				and Engineering】 (CAP.I419)
ENR.H476.L		★ <input type="checkbox"/>	Catalysis for the Environmental Issues	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I416)
ENR.H477.L		★ <input type="checkbox"/>	Introduction to Chemical Engineering (Unit Operation)	1-0-0	1,5	A	【Chemical Science and Engineering】 (CAP.I417)
ENR.H478.L		★ <input type="checkbox"/>	Advanced Organic Materials Chemistry	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I423)
ENR.H479.L		★ <input type="checkbox"/>	Advanced Geochemistry	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.I435)
ENR.H480.L		★	Nano-Surface Chemistry and Advanced Devices	1-0-0	1,2,5	B	【Chemical Science and Engineering】 (CAP.I446)
ENR.H481.L		★ <input type="checkbox"/>	Functionalized Nano-Materials Chemistry I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I438)
ENR.H482.L		★ <input type="checkbox"/>	Functionalized Nano-Materials Chemistry II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I445)
ENR.H486.L			Scope of Chemical Science and Engineering IB	1-0-0	1	A	【Chemical Science and Engineering】 (CAP.I401)
ENR.H487.L			Scope of Chemical Science and Engineering IIB	1-0-0	1	A	【Chemical Science and Engineering】 (CAP.I402)
ENR.H488.L		<input type="checkbox"/>	Introduction to the Frontiers of Environmental Chemistry I	1-0-0	1,2	B	【Chemical Science and Engineering】 (CAP.I481)
ENR.H489.L		<input type="checkbox"/>	Introduction to the Frontiers of Environmental Chemistry II	1-0-0	1,2	B	【Chemical Science and Engineering】 (CAP.I482)
ENR.H490.L			Frontiers of Chemical Science and Engineering I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.T423)
ENR.H496.L			Frontiers of Chemical Science and Engineering II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.T424)
ENR.H491.L		★ <input type="checkbox"/>	Introduction to Polymer Physical Chemistry	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.P433)

ENR.H492.L		★	Advanced Course of Step-growth Polymerization	1-0-0	1,4	B	【Chemical Science and Engineering】 (CAP.P413)
ENR.H493.L		★	Advanced Polymer Assembly	1-0-0	1,4	B	【Chemical Science and Engineering】 (CAP.P414)
Chemical Science and Engineering Course Track 500 Level							
ENR.E521.L		★ □	Advanced Chemistry of Transition Metal Complexes I	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A561)
ENR.E522.L		★ □	Advanced Chemistry of Transition Metal Complexes II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.A562)
ENR.E541.L		★ □	Advanced Polymer Reactions	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.P511)
ENR.E542.L		□	Advanced Polymer Processing	1-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.P581)
ENR.E543.L		□	Advanced Polymer Science I	1-0-0	1,2,5	B	【Chemical Science and Engineering】 (CAP.P582)
ENR.E544.L		□	Advanced Polymer Science II	1-0-0	1,2,5	B	【Chemical Science and Engineering】 (CAP.P583)
ENR.E551.L		★	Chemical Engineering in Global Business	1-0-0	1,2,3,5	B	【Chemical Science and Engineering】 (CAP.C521)
ENR.E552.L		★ □	Advanced Chemical Equipment Design	2-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.C531)
ENR.E553.L		★ □	Plasma Chemistry and Plasma Processing	1-0-0	1,4	B	【Chemical Science and Engineering】 (CAP.C533)
ENR.H527.L		★ □	Advanced Supercritical Fluid Process	1-0-0	1,4	B	【Chemical Science and Engineering】 (CAP.C534)
ENR.E554.L		★ □	Fine Particle Engineering	1-0-0	1,2,4,5	B	【Chemical Science and Engineering】 (CAP.C542)
ENR.H528.L		★ □	Tribology and Surface Engineering	1-0-0	1,2,5	B	【Chemical Science and Engineering】 (CAP.C543)
ENR.E561.L		★	Advanced Catalytic Reactions I	1-0-0	1	B	【Chemical Science



		<input type="checkbox"/>					and Engineering】 (CAP.T531)
ENR.E562.L		★ <input type="checkbox"/>	Advanced Catalytic Reactions II	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.T532)
ENR.E571.L		★ <input type="checkbox"/>	Advanced Strategic Organic Synthesis	1-0-0	1	B	【Chemical Science and Engineering】 (CAP.I533)
ENR.E572.L		★ <input type="checkbox"/>	Advanced Material Cycle Analysis	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.I536)
ENR.E573.L		★ <input type="checkbox"/>	Systematic Material Design Methodology	1-0-0	4,5	B	【Chemical Science and Engineering】 (CAP.I537)
ENR.H503.L		★ <input type="checkbox"/>	Advanced Polymer Design for Energy Materials	1-0-0	1,4,5	B	
ENR.H523.L		★ <input type="checkbox"/>	Advanced Molecular Design for Organic Synthesis I	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A521)
ENR.H524.L		★ <input type="checkbox"/>	Advanced Molecular Design for Organic Synthesis II	1-0-0	1,5	B	【Chemical Science and Engineering】 (CAP.A522)
ENR.H525.L		★ <input type="checkbox"/>	Advanced Polymer Structures	1-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.P522)
ENR.H526.L		★ <input type="checkbox"/>	Quantum Chemical Calculations for Polymer Chemistry	1-0-0	1,4,5	B	【Chemical Science and Engineering】 (CAP.P523)

Note :

- ◎ : Required course, ○ : Restricted elective, O : odd academic years, E : even academic years, ★ : Classes in English
- □ : Course recognized as equivalent to that of the Academy for Co-creative Education of Environment and Energy Science (ACEEES).
- Competencies: , 1 = Specialist skills, 2 = Intercultural skills, 3 = Communication skills, 4 = Critical thinking skills, 5 = Practical and/or problem-solving skills
- 【 】 Course offered by another graduate major
- The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ENR.D400.R): A (Interdisciplinary Scientific Principles of Energy Courses (electively required)), B (Interdisciplinary Scientific Principles of Energy Course (selective)), H (Chemical Science and Engineering Courses), I (Chemistry Courses), J (Materials Science and Engineering Courses), K (Mechanical Engineering Courses), L (Electrical and Electronic Engineering Courses), Z (Research Seminars) The character "R" succeeding the course number represents that the course is electively required (A), elective (L), and required (R), respectively.

## 6. IGP Courses That Can Be Counted as Humanities and Social Science Courses

None

## 7. IGP Courses That Can Be Counted as Career Development Courses

In order to fulfill the completion requirements for the master's degree program, students must attain at least 2 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table MA-1 of the "Career Development Courses" (Liberal Arts and Basic Science Courses) in the Guide to Graduate Education and International Graduate Program. Students will be evaluated in regards to GA achievements at the time of their degree completion. As to the courses with more than one GA, the number of GA stipulated for the courses is considered to be acquired regardless of the credits received for the courses.

Major Courses that enable students to acquire GA and that are recognized as equivalent to Career Development Courses are listed in Table M3 below.

However, it must be noted that credits attained from these courses cannot be counted more than once as Major Courses or Career Development Courses towards the completion requirements for the master's degree program.

For Graduate Attributes, refer to the Guide to the Career Development Courses.

The Graduate Attributes of the Master's Degree Program are listed in Table MA-1 as follows:

C0M: You will be able to delineate your career plan clearly and recognize the skills necessary to materialize that plan, taking into account its relation to society

C1M: You will be able to understand academic integrity, utilize your own expertise for the development of academia and technology, and work with others with different expertise to contribute to problem-solving

**Table M3. Courses of the Graduate Major in Energy Science and Engineering recognized as equivalent to Career Development Courses**

Course category	Course number	Course title	Credits	GA*	Learning goals	Comments
Courses that can be counted as Career Development Courses	ENR.B502.L	Energy innovation co-creative project	0-0-1	C1M	A,C,E	
	ENR.B503	Energy Engineering Internship A	0-0-1	C1M	C,D,E	Course outside the standard curriculum
	ENR.B504	Energy Engineering Internship B	0-0-2	C1M	C,D,E	Course outside the standard curriculum
	ENR.J409.L	Introduction to Intellectual Property System	2-0-0	C0M C1M	B,C	
	CHM.A461	Presentation Exercises in Chemistry	0-1-0	C0M	C,E	Available only to students belonging to the Department of Chemistry
	CHM.A462	Introductory Exercises in Chemistry	0-1-0	C1M	C,E	Available only to students belonging to the Department of Chemistry
	EEE.G401	Utilization of Intelligent Information Resources and Patents	1-0-0	C1M	B,E	Available only to students belonging to

							the Department of Electrical and Electronic Engineering
CAP.E521			Scientific Ethics	1-0-0	C0M	D	Available only to students belonging to the Department of Chemical Science and Engineering
CAP.E422			Presentation Practice	0-1-0	C1M	E	Available only to students belonging to the Department of Chemical Science and Engineering
CAP.E411			Advanced Internship in Chemical Science and Engineering I	0-0-1	C1M	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
CAP.E412			Advanced Internship in Chemical Science and Engineering II	0-0-2	C1M	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
ENR.B511.L		★	Energy Off-Campus Project S A	0-0-1	C1M	B,C,E	
ENR.B512.L		★	Energy Off-Campus Project S B	0-0-1	C1M	B,C,E	
ENR.B513.L		★	Energy Off-Campus Project S C	0-0-1	C1M	B,C,E	
ENR.B514.L		★	Energy Off-Campus Project S D	0-0-1	C1M	B,C,E	
ENR.B515.L		★	Energy Off-Campus Project L A	0-0-2	C1M	B,C,E	
ENR.B516.L		★	Energy Off-Campus Project L B	0-0-2	C1M	B,C,E	
ENR.B517.L		★	Energy Off-Campus Project L C	0-0-2	C1M	B,C,E	
ENR.B518.L		★	Energy Off-Campus Project L D	0-0-2	C1M	B,C,E	
ENR.B519.L		★	Energy International Workshop A	0-0-1	C1M	C,E	
ENR.B520.L		★	Energy International Workshop B	0-0-1	C1M	C,E	
ENR.B521.L		★	Energy International Workshop C	0-0-1	C1M	C,E	

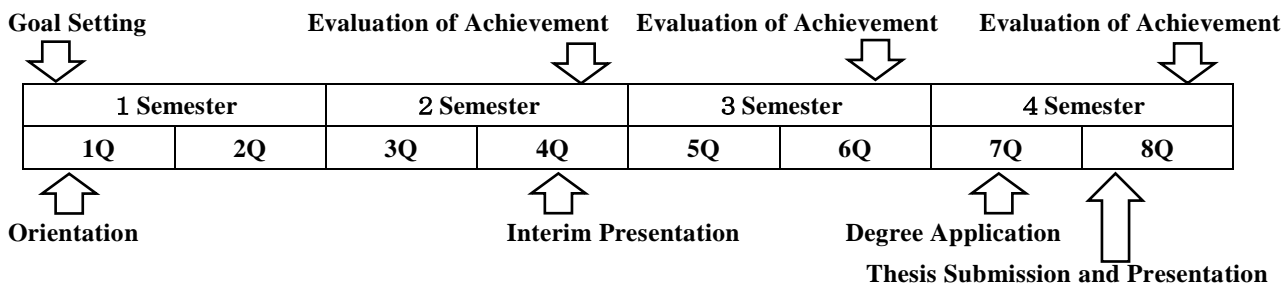
	ENR.B522.L		★	Energy International Workshop D	0-0-1	C1M	C,E	

**Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.**

**\* GA: Graduate Attributes**

**Research Related to the Completion of Master Thesis**

During the master’s thesis research the student acquires the abilities to identify and to solve new issues as well as develop technical communication skills by communicating the research results. The typical time line of the master’s thesis research is shown below. The learning objectives and research results will be evaluated by the candidate’s supervisor. The candidate will develop his or her study plan based on the goals and progress during the master’s thesis research.



- Interim Presentation of Master’s Thesis

To understand background, purposes, and issues of his or her own master’s thesis research, “Interim Presentation of Master’s Thesis” is required.

- Screening Criteria for Master’s Thesis

A master’s thesis must include new knowledge contributing to the development in energy science and engineering and which is also original.

- Screening of Master’s Thesis

Prior to the final screening, the thesis will be reviewed by examiners. Final screening and evaluation of the thesis is based on the student’s oral presentation. Oral presentation must be carried out in English or Japanese.

## **【Doctoral Degree Program】**

### **1. Outline**

To integrate and reorganize the inter-relationships in conventional energy-related disciplines, which developed with differentiation and deepening, creation of a novel discipline, “Interdisciplinary Scientific Principles of Energy”, and development of human resources mastering this discipline have been strongly required for overlooking of energy issues and effectively utilization of energy-related disciplines.

In the Doctoral Degree Program, the Energy Science and Engineering Major aims at nurturing an independent research scientist and engineer with advanced expert knowledge in the field of energy science and engineering. Students in this major are expected to pursue the principles of energy-related phenomena by using knowledge in the field of energy science and engineering and to lead a cutting-edge research and development in consideration of societal responsibilities and ethics as well as acquire competence as a global leader who contributes to create a sustainable society.

### **2. Competencies Developed**

The students are expected to acquire,

- Abilities to identify, to investigate, and to solve new issues by using knowledge in the field of energy science and engineering.
- Ability to conduct innovative research and development in an ethical manner.
- Management and technical communication skills by integrating energy-related findings from the viewpoint as an expert of energy-related discipline.
- Competence as a global leader in the energy-related fields.

### **3. Learning Goals**

Students will learn,

#### A) Advanced expert knowledge in the field of energy science and engineering

Students will gain expert knowledge in greater depth than the master course and to have the ability to apply the knowledge to energy-related phenomena through the doctoral coursework Core Courses and Research Seminars.

#### B) Ability to solve problems

Students are requested to acquire the ability to find out research problems and solve them by integrating their original discipline such as in chemistry, applied chemistry, material science, mechanical engineering, energy based economics or electrical engineering with other energy-related disciplines.

#### C) Ability to create solutions

Students are requested to acquire the ability to create solutions by freely utilizing their original discipline and other energy-related disciplines.

#### D) Competency as a global leader in energy research

Students will acquire the abilities to evaluate their research perspectives and applications from the global point of view, establishing a human network, and lead frontier energy science and engineering, by integrating energy-related disciplines.

E) Communication skills

Develop technical communication skills through discussions with expert scientists in the domestic and international community and presenting their own research results.

#### **4. IGP Completion Requirements**

The following requirements must be met to complete the Doctoral Degree Program of this major.

1. Attain a total of 24 credits or more from 600-level courses.
2. From the courses specified in the Graduate Major in Energy Science and Engineering curriculum,
  - 12 credits acquired from Research Seminars;
  - 18 credits or more, acquired from the subject in 600-level courses of this major;
  - a minimum of 6 credits acquired from Major Courses; and
  - a minimum of 6 credits acquired from Liberal Arts and Basic Science Courses  
(2 credits from Humanities and Social Sciences Courses, and 4 credits from Career Development Courses).
3. Pass the doctoral thesis review and defense.

Table D1 shows course categories and the number of credits required to complete the Doctoral Degree Program of this major. It also shows the required minimum credits in each course category and points to be noted when selecting the required courses and electives.

The learning goals to be obtained by students through courses are listed as “associated learning goals”. Prior to registering courses, students need to fully understand the course goals.

**Table D1 Graduate Major in Energy Science and Engineering Completion Requirements**

Course category		<Required courses> Required credits	<Electives> Minimum credits required	Minimum credits required	Associated learning goals	Comments
Liberal arts and basic science courses	Humanities and social science courses		2 credits	6 credits	B	
	Career development courses		4 credits		C,D,E	All Graduate Attributes (GA) should be acquired. (Refer to Section 7 for the definition of GA.)
	Other courses					
Core courses	Research seminars	Seminar in Energy Science S3 Seminar in Energy Science F3 Seminar in Energy Science S4 Seminar in Energy Science F4 Seminar in Energy Science S5 Seminar in Energy Science F5  A total of 12 credits, 2 credits each from the above courses.		18 credits	A,B,C,D,E	
	Research-related courses				C,D,E	
	Major courses		6 credits		A,B,C,D	
	Major courses and Research- related courses <u>outside</u> the Graduate Major in Energy Science and Engineering standard curriculum					
<b>Total required credits</b>		<b>A minimum of 24 credits including those attained according to the above conditions</b>				
<b>Note</b>		<ul style="list-style-type: none"> <li>• Japanese Language and Culture Courses offered to international students can be recognized as equivalent to the Humanities and Social Science Courses of the corresponding course level.</li> <li>• For details of the Liberal Arts and Basic Science Courses, please refer to the relevant sections.</li> </ul>				



## 5. IGP Courses

Table D2 shows the Core Courses of the Doctoral Degree Program of this major. Graduate Majors listed in the Comments column offer core courses that are recognized as equivalent to the corresponding Major Courses or Research-related Courses in the standard curriculum of this major.

**Table D2. Core Courses of the Graduate Major in Energy Science and Engineering**

Course category	Course number	Course title	Credits	Competencies	Learning goals	Comments	
Research seminars	600 level	ENR.Z691.R	◎	Seminar in energy science S3	0-0-2	1,3,4,5	A,B,C
		ENR.Z692.R	◎	Seminar in energy science F3	0-0-2	1,3,4,5	A,B,C
		ENR.Z693.R	◎	Seminar in energy science S4	0-0-2	1,3,4,5	A,B,C
		ENR.Z694.R	◎	Seminar in energy science F4	0-0-2	1,3,4,5	A,B,C
		ENR.Z695.R	◎	Seminar in energy science S5	0-0-2	1,3,4,5	A,B,C
		ENR.Z696.R	◎	Seminar in energy science F5	0-0-2	1,3,4,5	A,B,C
Major courses	600 level	ENR.E601.L		Practical Presentation A	0-0-1	1,3	A,B,C,E
		ENR.E602.L		Practical Presentation B	0-0-1	1,3	A,B,C,E
		ENR.E603.L		Practical Presentation C	0-0-1	1,3	A,B,C,E
		ENR.E618.L		Practical Presentation W1	0-0-1	1,3	A,B,C,E
		ENR.E604.L	★	International scientific presentation A	0-0-1	1,3	A,B,C,D,E
		ENR.E605.L	★	International scientific presentation B	0-0-1	1,3	A,B,C,D,E
		ENR.E606.L	★	International scientific presentation C	0-0-1	1,3	A,B,C,D,E
		ENR.E619.L	★	International scientific presentation W1	0-0-1	1,3	A,B,C,D,E
		ENR.E607.L		Practical research in energy science A	0-0-1	1,4	A,B,C
		ENR.E608.L		Practical research in energy science B	0-0-1	1,4	A,B,C
		ENR.E613.L		Practical research in energy science C	0-0-1	1,3,4	A,B,C

ENR.E614.L			Practical research in energy science D	0-0-1	1,3,4	A,B,C	
ENR.E609.L			Academic teaching	0-1-0	1,3	D,E	
ENR.E610.L		★ □	Academic Writing A	1-0-0	3,4	A,C,E	
ENR.E611.L		★ □	Academic Writing B	1-0-0	2,3,4	A,C,E	
ENR.E612.L		★	International energy project	0-0-2	2,3,4,5	C,D,E	
ENR.E615.L			Special Experiment and Practice for Working Adults in Energy Science and Engineering 1	0-0-1	1,4,5	C	
ENR.E616.L			Special Experiment and Practice for Working Adults in Energy Science and Engineering 2	0-0-1	1,4,5	C	
ENR.E617.L			Special Experiment and Practice for Working Adults in Energy Science and Engineering 3	0-0-1	1,4,5	C	
ENR.L601.L		★	Advanced Topics in Digital VLSI Design	1-0-0	1,4	A,B	【School of Engineering】 (XEG.S605)
ENR.P601.L		★	Energy Science and Engineering Project	0-0-2	3,4	A,E	
ENR.R602.L		★	Energy Science and Engineering Off-Campus Project D1c	0-0-2	3,4,5	A,C,E	
ENR.R603.L		★	Energy Science and Engineering Off-Campus Project D2c	0-0-4	3,4,5	A,C,E	
ENR.K601.L		★	Special Lecture in Mechanical Engineering I	1-0-0	1,2	B	【Mechanical Engineering】 (MEC.N631)
ENR.K602.L		★	Special Lecture in Mechanical Engineering II	1-0-0	1,2	B	【Mechanical Engineering】 (MEC.N632)
ENR.K603.L		★	Special Lecture in Mechanical Engineering III	1-0-0	1,2	B	【Mechanical Engineering】 (MEC.N633)
ENR.K604.L		★	Special Lecture in Mechanical Engineering IV	1-0-0	1,2	B	【Mechanical Engineering】 (MEC.N634)

Note :

- ◎ : Required course, ★ : Classes in English
- □ : Course recognized as equivalent to that of the Academy for Co-creative Education of Environment and Energy Science (ACEEES).
- Competencies: 1 = Specialist skills, 2 = Intercultural skills, 3 = Communication skills,, 4 = Critical thinking skills,

5 = Practical and/or problem-solving skills

- Course offered by another graduate major
- The character preceding the three digits in the course number denotes the course's subdiscipline (i.e., "D" represents the subdiscipline code in the course number ENR.D600.R): E (Major Courses), Z (Research Seminars). The character "R" succeeding the course number represents that the course is elective (L) and required (R), respectively.

## 6. IGP Courses That Can Be Counted as Humanities and Social Science Courses

None

## 7. IGP Courses That Can Be Counted as Career Development Courses

In order to fulfill the completion requirements for the doctoral degree program, students must attain at least 4 credits in Career Development Courses, and should satisfy all of the Graduate Attributes (GA) specified in Table A-1 or A-2 of the "Career Development Courses" (Liberal Arts and Basic Science Courses) in the Guide to Graduate Education and International Graduate Program. Students will be evaluated in regards to GA achievements at the time of their degree completion. As to the courses with more than one GA, the number of GA stipulated for the courses is considered to be acquired regardless of the credits received for the courses.

Major Courses that enable students to acquire GA and that are recognized as equivalent to Career Development Courses are listed in Tables D3-1 and D3-2 below.

However, it must be noted that credits attained from these courses cannot be counted more than once as Major Courses or Career Development Courses towards the completion requirements for the doctoral degree program.

For Graduate Attributes, refer to the Guide to the Career Development Courses.

The Graduate Attributes of the Academic Leader Program (ALP) are listed in Table A-1 as follows:

- A0D: You will be able to precisely define your own career plan and train yourself to acquire the skills required for attaining your goals in academia
- A1D: You will be able to ascertain the true nature of phenomena, master the secret of learning, and lead the vanguard of a new academic discipline or research area
- A2D: You will be able to understand the position of academia in society as well as the notion of responsible conduct of research, and adequately explain academic progress to members of society, who are our stakeholders
- A3D: With the understanding of the social roles and responsibilities of researchers, you will be able to nurture next-generation experts in educational institutions, instilling in them an interest in academia and enabling them to later join in the pioneering of new academic disciplines or research areas

The Graduate Attributes of the Productive Leader Program (PLP) are listed in Table A-2 as follows:

- P0D: You will be able to precisely plot your own career plan and train yourself to acquire the skills required for attaining your goals in industry, etc.
- P1D: You will be able to precisely grasp the needs of society and detect its problems, comprehend relevant laws, regulations, or guidelines for responsible conduct of research, and lead future developments in science and technology
- P2D: While leading teams consisting of members with varied specialties and value systems, you will be able to create products and enterprises that bring forth new values in society
- P3D: With the understanding of the social roles and responsibilities of engineers, you will be able to nurture next-generation

experts through the project, enabling them to help drive future development of society and industry

**Table D3-1. Courses of the Graduate Major in Energy Science and Engineering recognized as equivalent to Career Development Courses in the Academic Leader Program (ALP)**

Course category	Course number	Course title	Credits	GA*	Learning goals	Comments	
Courses that can be counted as Career Development Courses	ENR.E607.L		Practical research in energy science A	0-0-1	A1D A2D	A,B,C	
	ENR.E608.L		Practical research in energy science B	0-0-1	A1D A2D	A,B,C	
	ENR.E604.L	★	International scientific presentation A	0-0-1	A1D	A,B,C,D,E	
	ENR.E605.L	★	International scientific presentation B	0-0-1	A1D	A,B,C,D,E	
	ENR.E606.L	★	International scientific presentation C	0-0-1	A1D	A,B,C,D,E	
	ENR.E619.L	★	International scientific presentation W1	0-0-1	A1D	A,B,C,D,E	
	ENR.E609.L		Academic teaching	0-1-0	A3D	D,E	
	ENR.E612.L	★	International energy project	0-0-2	A1D A2D	C,D,E	
	ENR.P601.L	★	Energy Science and Engineering Project	0-0-2	A1D	A,E	
	ENR.R602.L	★	Energy Science and Engineering Off-Campus Project D1c	0-0-2	A1D	A,C,E	
	ENR.R603.L	★	Energy Science and Engineering Off-Campus Project D2c	0-0-4	A1D	A,C,E	
	CHM.A661	★	Basic Exercises in Global Presentation	0-1-0	A1D A2D	C	Available only to students belonging to the Department of Chemistry
	CHM.A662	★	Advanced Exercises in Global Presentation	0-1-0	A2D A3D	C	Available only to students belonging to the Department of Chemistry
	CHM.A651		Laboratory Training of Advanced Chemistry I	0-0-1	A2D A3D	C	Available only to students belonging to the Department of Chemistry
	CHM.A652		Laboratory Training of Advanced Chemistry II	0-0-1	A2D A3D	C	Available only to students belonging to the Department of Chemistry
CHM.A653		Laboratory Training of Advanced Chemistry III	0-0-1	A2D A3D	C	Available only to students belonging to the	

							Department of Chemistry
CHM.A654			Laboratory Training of Advanced Chemistry IV	0-0-1	A2D A3D	C	Available only to students belonging to the Department of Chemistry
MEC.T631			Teaching Practice in Mechanical Engineering	0-0-2	A2D A3D	D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R631			Off Campus Project D1c	0-0-1	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R632			Off Campus Project D2c	0-0-2	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R633			Off Campus Project D3c	0-0-3	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R634			Off Campus Project D4c	0-0-4	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R635			Off Campus Project D5c	0-0-5	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R636			Off Campus Project D6c	0-0-6	A2D A3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.S631			Overseas Research Project D1c	0-0-1	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S632			Overseas Research Project D2c	0-0-2	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S633			Overseas Research Project D3c	0-0-3	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering

MEC.S634			Overseas Research Project D4c	0-0-4	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S635			Overseas Research Project D5c	0-0-5	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S636			Overseas Research Project D6c	0-0-6	A2D A3D	E	Available only to students belonging to the Department of Mechanical Engineering
EEE.G601		★	Teaching Skills in English for Doctoral Course Students	0-1-0	A1D	D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R611		★	Doctor Course Colloquium	0-1-0	A2D A3D	C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R621		★	International Presentations	0-1-0	A2D A3D	C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R601			Training on Teaching Technique	0-1-0	A1D A2D A3D	C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R651		★	Study Abroad (Doctor Course) A	0-0-1	A1D A2D A3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R652		★	Study Abroad (Doctor Course) B	0-0-2	A1D A2D A3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R653		★	Study Abroad (Doctor Course) C	0-0-4	A1D A2D	B,D,E	Available only to students belonging to the

					A3D		Department of Electrical and Electronic Engineering
EEE.R654		★	Study Abroad (Doctor Course) D	0-0-6	A1D A2D A3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R661			Internship (Doctor Course) A	0-0-1	A1D A2D A3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R662			Internship (Doctor Course) B	0-0-2	A1D A2D A3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R663			Internship (Doctor Course) C	0-0-4	A1D A2D A3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R664			Internship (Doctor Course) D	0-0-6	A1D A2D A3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
MAT.A661			Materials Off-campus Project 1	0-0-1	A1D, A2D, A3D	D	Available only to students belonging to the Department of Materials Science and Engineering
MAT.A662			Materials Off-campus Project 2	0-0-2	A1D, A2D, A3D	D	Available only to students belonging to the Department of Materials Science and Engineering
MAT.A663			Materials Off-campus Project 3	0-0-4	A1D, A2D, A3D	D	Available only to students belonging to the Department of Materials Science and Engineering
MAT.A664			Materials Off-campus Project 4	0-0-6	A1D, A2D, A3D	D	Available only to students belonging to the Department of Materials Science and Engineering

	CAP.E631			Chemical Science and Engineering Off-Campus Project 1	0-0-1	A1D, A2D, A3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E632			Chemical Science and Engineering Off-Campus Project 2	0-0-2	A1D, A2D, A3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E633			Chemical Science and Engineering Off-Campus Project 3	0-0-4	A1D, A2D, A3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E634			Chemical Science and Engineering Off-Campus Project 4	0-0-6	A1D, A2D, A3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
<p><b>Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.</b></p> <p><b>* GA: Graduate Attributes</b></p>								

**Table D3-2. Courses of the Graduate Major in Energy Science and Engineering recognized as equivalent to Career Development Courses in the Productive Leader Program (PLP)**

Course category	Course number		Course title	Credits	GA*	Learning goals	Comments
<b>Courses that can be counted as Career Development Courses</b>	ENR.E607.L		Practical research in energy science A	0-0-1	P1D P2D	A,B,C	
	ENR.E608.L		Practical research in energy science B	0-0-1	P1D P2D	A,B,C	
	ENR.E604.L	★	International scientific presentation A	0-0-1	P1D	A,B,C,D,E	
	ENR.E605.L	★	International scientific presentation B	0-0-1	P1D	A,B,C,D,E	
	ENR.E606.L	★	International scientific presentation C	0-0-1	P1D	A,B,C,D,E	
	ENR.E619.L	★	International scientific presentation W1	0-0-1	P1D	A,B,C,D,E	
	ENR.E612.L	★	International energy project	0-0-2	P1D P2D	C,D,E	
	ENR.P601.L	★	Energy Science and Engineering Project	0-0-2	P1D	A,E	
	ENR.R602.L	★	Energy Science and Engineering Off-Campus Project D1c	0-0-2	P1D	A,C,E	
	ENR.R603.L	★	Energy Science and Engineering Off-	0-0-4	P1D	A,C,E	



			Campus Project D2c				
CHM.A661		★	Basic Exercises in Global Presentation	0-1-0	P1D P2D	C	Available only to students belonging to the Department of Chemistry
CHM.A662		★	Advanced Exercises in Global Presentation	0-1-0	P2D P3D	C	Available only to students belonging to the Department of Chemistry
CHM.A651			Laboratory Training of Advanced Chemistry I	0-0-1	P2D P3D	C	Available only to students belonging to the Department of Chemistry
CHM.A652			Laboratory Training of Advanced Chemistry II	0-0-1	P2D P3D	C	Available only to students belonging to the Department of Chemistry
CHM.A653			Laboratory Training of Advanced Chemistry III	0-0-1	P2D P3D	C	Available only to students belonging to the Department of Chemistry
CHM.A654			Laboratory Training of Advanced Chemistry IV	0-0-1	P2D P3D	C	Available only to students belonging to the Department of Chemistry
MEC.R631			Off Campus Project D1c	0-0-1	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R632			Off Campus Project D2c	0-0-2	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R633			Off Campus Project D3c	0-0-3	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R634			Off Campus Project D4c	0-0-4	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R635			Off Campus Project D5c	0-0-5	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.R636			Off Campus Project D6c	0-0-6	P2D P3D	C,D	Available only to students belonging to the Department of Mechanical Engineering
MEC.S631			Overseas Research Project D1c	0-0-1	P2D	E	Available only to students

					P3D		belonging to the Department of Mechanical Engineering
MEC.S632			Overseas Research Project D2c	0-0-2	P2D P3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S633			Overseas Research Project D3c	0-0-3	P2D P3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S634			Overseas Research Project D4c	0-0-4	P2D P3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S635			Overseas Research Project D5c	0-0-5	P2D P3D	E	Available only to students belonging to the Department of Mechanical Engineering
MEC.S636			Overseas Research Project D6c	0-0-6	P2D P3D	E	Available only to students belonging to the Department of Mechanical Engineering
EEE.G601		★	Teaching Skills in English for Doctoral Course Students	0-1-0	P1D	D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R611		★	Doctor Course Colloquium	0-1-0	P2D P3D	C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R621		★	International Presentations	0-1-0	P1D P2D P3D	C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R651		★	Study Abroad (Doctor Course) A	0-0-1	P1D P2D P3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R652		★	Study Abroad (Doctor Course) B	0-0-2	P1D	B,D,E	Available only to students

					P2D P3D		belonging to the Department of Electrical and Electronic Engineering
EEE.R653		★	Study Abroad (Doctor Course) C	0-0-4	P1D P2D P3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R654		★	Study Abroad (Doctor Course) D	0-0-6	P1D P2D P3D	B,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R661			Internship (Doctor Course) A	0-0-1	P1D P2D P3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R662			Internship (Doctor Course) B	0-0-2	P1D P2D P3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R663			Internship (Doctor Course) C	0-0-4	P1D P2D P3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
EEE.R664			Internship (Doctor Course) D	0-0-6	P1D P2D P3D	B,C,D,E	Available only to students belonging to the Department of Electrical and Electronic Engineering
MAT.A661			Materials Off-campus Project 1	0-0-1	P1D, P2D, P3D	D	Available only to students belonging to the Department of Materials Science and Engineering
MAT.A662			Materials Off-campus Project 2	0-0-2	P1D, P2D, P3D	D	Available only to students belonging to the Department of Materials Science and Engineering
MAT.A663			Materials Off-campus Project 3	0-0-4	P1D, P2D,	D	Available only to students belonging to the

					P3D		Department of Materials Science and Engineering
	MAT.A664		Materials Off-campus Project 4	0-0-6	P1D, P2D, P3D	D	Available only to students belonging to the Department of Materials Science and Engineering
	CAP.E631		Chemical Science and Engineering Off-Campus Project I	0-0-1	P1D, P2D, P3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E632		Chemical Science and Engineering Off-Campus Project II	0-0-2	P1D, P2D, P3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E633		Chemical Science and Engineering Off-Campus Project III	0-0-4	P1D, P2D, P3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering
	CAP.E634		Chemical Science and Engineering Off-Campus Project IV	0-0-6	P1D, P2D, P3D	B,D	Available only to students belonging to the Department of Chemical Science and Engineering

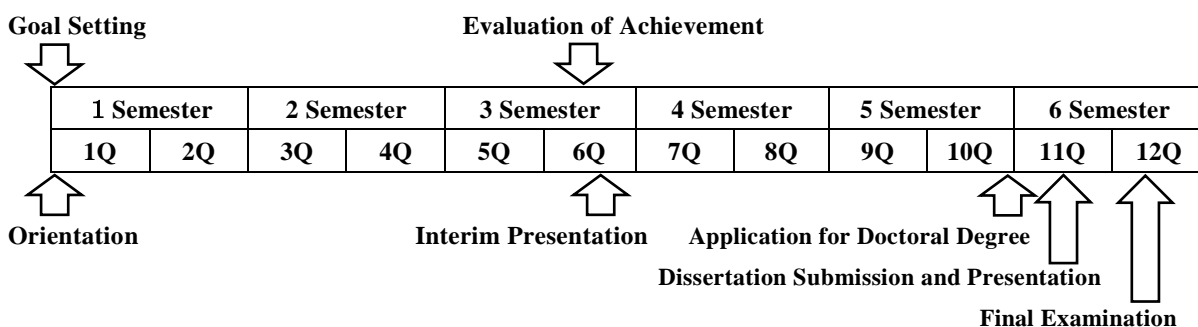
**Credits in Career Development Courses must be attained from among the above-listed courses and those listed as such in the Liberal Arts and Basic Science Courses Guide.**

**\* GA: Graduate Attributes**

Students enrolled in the educational program for leading graduate schools, the Tokyo Tech Academy for Leadership (ToTAL) or the Tokyo Tech Academy for Convergence of Materials and Informatics (TAC-MI) may be offered courses recognized as equivalent to Career Development Courses besides those listed as such in the “Liberal Arts and Basic Science Courses” in the Guide to Graduate Education and International Graduate Program. For details about available courses or completion requirements, please refer to the Study Guide of the Academy that offers the relevant program.

**Research Related to the Completion of Doctoral Thesis**

The doctoral dissertation research aims to acquire the abilities to identify, to investigate, and to solve new issues by using organized knowledge in the field of energy science and engineering. In addition, improvement in English communication skill is strongly required. These abilities will be acquired through the process of goal setting, coursework, research activities, presentations and evaluation of the achievement. The typical time line of the doctoral dissertation research is shown as follows.



• **Criteria for Doctoral Dissertation**

A doctoral dissertation must be prepared that has sufficient novelty, originality, and academic value in the field of energy science and engineering. The dissertation must be written in English or Japanese.

• **Doctoral Dissertation Examination**

The examination committee shall consist of multiple examiners who can evaluate the dissertation from an academic and a research advancement point of view. The committee can also include external examiners who belong to other universities, institutions, and companies. After the submission of doctoral dissertation, the final screening and evaluation will be carried out via oral presentation and reviewed by the dissertation examiners. Oral presentation must be carried out in English or Japanese.