

Appended Form 1

Specifications for Major Program

Name of School (Program) School of Engineering Cluster 1 [Mechanical Systems, Transportation, Material and Energy)]

Program name (Japanese)  (English)	エネルギー変換プログラム
	Program of Energy Transform Engineering
1.Academic degree to be Acquired : Bachelor's degree in Engineering	

2. Overview

(1) Overview of “English-based Bachelor’s Degree Program”

This program aims to foster and produce future members of a global society who have the knowledge to be innovative, creative, take leadership, and possess language abilities that will help them play an important role in the international world.

This program focuses specifically on producing individuals who are capable of addressing various global issues

and of indispensable for such fields of engineering as thermodynamics, basic physics related to quantum physics, fluid dynamics, combustion engineering, and heat-transfer engineering.

- The ability to assume roles in the design and development of cutting-edge production technology, while having a broader perspective about human-machine relations and environmental issues.

#### 4. Curriculum Policy (Policy for Preparing and Implementing the Curriculum )

Achievement in learning is measured by performance rating in each subject and by the goals set by the Education Program. To ensure that students are able to achieve the goals of the program, the Program of Energy Transform Engineering develops and puts into practice a curriculum based on the following policy:

- In the first year, the students take Liberal Arts Education subjects such as Peace Science Courses, Basic Courses in University Education, common subjects, and Foundation Courses, as well as specialized basic subjects and specialized practical education, such as machine shop training.
- In the second year, specialized basic subjects such as “Fluid Dynamics ” and “Thermodynamics ” become major subjects. The students choose one of four programs in Cluster 1(Mechanical Systems Engineering, Transportation Systems, Material Processing, or Energy Transform Engineering) and are assigned to that program.
- In the third year, specialized subjects become major subjects. The students take required classes in accordance with the program they belong to.
- In the fourth year, the students are assigned to their respective research laboratories, choose their research topics, and write their graduation theses.

In the curriculum described above, teaching and learning will be implemented by utilizing active learning and online classes, depending on the delivery methods of the program, such as lectures and seminars.

In addition to strict grading using the standards clearly outlined in the syllabus, learning outcomes are evaluated based on the degree to which the goals set by the educational program are achieved.

#### 5. Program Timing/Acceptance Conditions

- When to start the program : The English-based Bachelor's Degree programs begin in the first semester of the first year. Enrollment in Program of Energy Transform Engineering occurs in the second semester of the second year.
- Additional Requirements : To determine acceptance into the English-based Bachelor's Degree program, all applicants are required to have an individual consultation with the faculty committee members.
- Credit Requirements : By the first semester of the second year, students must have acquired the Liberal Arts Education subjects and specialized basic subjects that are commonly specified in Cluster 1.

#### 6. Qualifications to be Acquired

Type-1 High School Teaching License (Industry)

(Students must acquire the required number of credits for the Type-1 High School Teaching License (Industry), in addition to the required number of credits for this program.)

#### 7. Class subjects and course content

- \* For class subjects, see the Course List table on the attached sheet.
- \* For course content, see the syllabus for each fiscal year.
- \* All class subjects are taught in Japanese. Course materials will be written in both Japanese and English or only English.

#### 8. Academic Achievements

At the end of each semester, the evaluation criteria are applied to each academic achievement evaluation item so that the level of attainment is clearly demonstrated.

Students' grade calculation for each subject, from admission to the current semester, is given in one of three levels: “Excellent,” “Very Good,” and “Good,” based on evaluation criteria calculated by adding the weighted values to the numerically-converted values of their academic achievement in each subject being evaluated (S = 4, A = 3, B = 2, and C= 1).

Academic achievement	Evaluation
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Evaluation of academic achievement	Converted values		criteria
S(Excellent: 90 points or higher)	4	Excellent	3.00~4.00
A(Superior:80-89 points)	3	Very Good	2.00~2.99
B(Good: 70-79 points)	2	Good	1.00~1.99
C(Fair: 60-69 points)	1		

\* For the relationship between evaluation items and evaluation criteria, see the attached Sheet 2 .

\* For the relationship between evaluation items and class subjects, see the attached Sheet 3.

\* For the curriculum map, see the attached Sheet 4.

### 9. Graduation Thesis (Graduation Research) (Positioning, when and how it is assigned, etc.)

- Positioning

The graduation thesis is designed to be one component of the overall evaluation of academic achievement. It is positioned as one of the major subjects to evaluate the following:

Ability/Skills (2) Developing the ability to solve engineering issues on one's own initiative with flexible thinking and creativity

Collective capacity (1) Developing communication skills and the ability to globally collect and dispatch information.
- When and how it is assigned

When it is assigned: At the start of the fourth year. (Only those who satisfy the conditions for embarking on a graduation thesis will be assigned a thesis.)
- Conditions for embarking on a graduation thesis
  - (1) Students must gain 43 credits or more out of 46 credits, the required number for graduation in Liberal Arts Education subjects.
  - (2) Students must gain 10 credits or more in the first group of specialized basic subjects
  - (3) Students must gain all of the required credits in Machine Design and Drawing, CAD, Machine Shop Training, Experiments in Mechanical Engineering and Mechanical Engineering Design and Production.
  - (4) Students must gain 11 credits or more out of 15 credits, the required number in Liberal Arts Education subjects, in the second group of specialized basic subjects.
  - (5) Students must gain a total of 68 credits or more in specialized basic subjects and specialized subjects.
- How it is assigned

The research details of each laboratory to which the students can be assigned are explained by giving out handouts at a briefing held in February, in the second semester of the third year. After the number of students acceptable to each laboratory is given at the start of the fourth year, students who can begin their graduation theses are assigned as requested. In the case that the number of students exceeds the acceptable limit for a laboratory, adjustments may be made.

The graduation thesis must be written in English in “English-based Bachelor's Degree Program”.

### 10. Responsibility-taking System

(1) PDCA Responsibility-taking System (“Plan,” “Do,” “Check,” and “Act”)

The cluster leader and program leader are responsible for executing this program. Faculty committee members responsible for this program make plans, while self-check/evaluation committee members responsible for this program make evaluations. The cluster and program teachers committee scrutinize the plans and evaluations from time to time for further improvement. When major issues arise, a working group may be established at the discretion of cluster leader and program leader.

(2) Program assessment

- Criteria for program assessment
  - Whether or not each class subject is properly allocated in light of the goals of the program, and whether course content is appropriate
  - Whether or not, on average, students taking the course have achieved or exceeded the goals
  - Whether or not the system runs in proper cycles that enable the continuous improvement of the program
- How the program is assessed

- Conducting self-assessment for each subject based on class improvement questionnaires from students who have taken course, and based on performance rating results
- Conducting questionnaires (obtained at graduation) in suitable cycles, to evaluate the validity of the goals
- Position on feedback to students and how it should be conducted

Search records of each student's learning status, prepared by tutors, are kept in the office. Based on these records, study guidance is given to each student. At the same time, requests from students are discussed at teachers' meetings as needed. Furthermore, based on the results of the course improvement questionnaires obtained from students, subject teachers draw up class improvement plans that reflect the questionnaire results.



## Cluster 1 Basic Specialized Subjects

Required subject

Compulsory elective subject

Free elective subject

	Class Subjects	Credits	Type of course registration				Class Hours/Week																Note	
			Mechanical Systems Engineering	Transportation Systems	Materials Processing	Energy Transform Engineering	1st grade				2nd grade				3rd grade				4th grade					
							Spring		Fall		Spring		Fall		Spring		Fall		Spring		Fall			
							1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T	1T	2T	3T	4T		
1st group	Applied Mathematics I	2							4															
	Applied Mathematics II	2								4														
	Applied Mathematics III	2									4													
	Engineering Mathematics A	2											4											
	Engineering Mathematics C	2										4												
	Probability and Statistics	2								4														
	Synthesis of Applied Mathematics	2													4									
	Practice of Mechanics	1							4															
	Introduction of Mechanical and Transportation Engineering	2							4															
	Technical English	1									2	2												
Basic Engineering Computer Programming	2										4													
2nd group	Mechanics of Material I	2									4													
	Thermodynamics I	2									4													
	Fluid Dynamics I	2										4												
	Control Engineering I	2										4												
	An Introduction to Engineering Materials	2									4													
	Fundamentals of Materials Processing	2										4												
	Machine Design and Drawing	1							3	3														
	Computer Aided Design	1									3	3												
	Machine Shop Training (a)	1							3	3														
	Machine Shop Training (b)	1									3	3												

Students can select either Machine Shop Training (a) or Machine Shop Training (b)



## Academic Achievement in Educational Program for Energy Transform Engineer

### The Relationship between Evaluation Items and Evaluation Criteria

Academic Achievements			Evaluation Criteria		
Evaluation Items			Excellent	Very Good	Good
Knowledge and Understanding	(1)	To develop the ability to work positively and independently on the development of local societies, international society, and business and industries.	To be able to be sufficiently engaged in the development of local societies, international society, and business and industry.	To be able to be engaged in the development of local societies, international society, and business and industry at the standard level.	To be able to be engaged in the development of local societies, international society, and business and industry at the minimum level.
	(2)	Acquiring necessary basic knowledge for an engineer and developing the ability to consider logically.	Acquiring necessary basic knowledge for an engineer and being able to sufficiently and logically consider it.	Acquiring necessary basic knowledge for an engineer and being able to logically consider it at the standard level.	Acquiring necessary basic knowledge for an engineer and being able to logically consider it at the minimum level.
Abilities and Skills	(1)	Acquiring basis of mechanical system engineering steadily and developing the applied skill.	Acquiring basis of mechanical system engineering steadily, and being able to apply it sufficiently.	Acquiring basis of mechanical system engineering steadily, and being able to apply it at the standard level.	Acquiring basis of mechanical system engineering steadily, and being able to apply it at the minimum level.
	(2)	Developing the ability of solving the technological issues with flexible ideas and creativity.	Based on flexible ideas and creativity, to be able to sufficiently solve problems related to engineering.	Based on flexible ideas and creativity, to be able to independently solve problems related to engineering to the standard level.	Based on flexible ideas and creativity, to be able to independently solve problems related to engineering at the minimum level.
Overall Abilities	(1)	Cultivating abilities of communication and of internationally collecting information and releasing it	To be able to communicate sufficiently with others, collect and release information internationally.	To be able to communicate with others, collect and release information internationally at the standard level	To be able to communicate with others, collect and release information internationally at the minimum level.

### Placement of the Liberal Arts Education in the Major Program

We aim to cultivate a well-rounded character, backed up by a broad range of basic knowledge and an understanding of global environmental issues and problems in the social environment. Furthermore, we aim to cultivate the ability to consider ways to solve problems in the context of the multifaceted relations between people and society, and between nature and engineering. To that end, the following are offered: (1) The acquisition of the necessary abilities and attitudes to see various social issues multilaterally and to understand the complete picture (2) The acquisition of a broader perspective after being exposed to fields outside of one's area of expertise (3) Through sports, the acquisition of knowledge of health and physical strength that form basis of human living (4) The cultivation of the ability to



### Relationships between the evaluation items and class subjects

					Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject
Liberal Arts Education	Introduction to University Education	2	Required	1semester-1T	100	1											100
Liberal Arts Education	Introductory Seminar for First-Year Students	2	Required	1semester						50	1	50	1				100
Liberal Arts Education	Peace Science Courses	2	Elective	1semester-2T	100	1											100
Liberal Arts Education	Basic English UsageI	1	Required	1semester								100	1				100
Liberal Arts Education	Basic English UsageII	1	Required	2semester								100	1				100
Liberal Arts Education	CommunicationIA	1	Required	1semester								100	1				100
Liberal Arts Education	Communication IB	1	Required	1semester								100	1				100
Liberal Arts Education	Communication IIA	1	Required	2semester								100	1				100
Liberal Arts Education	Communication IIB	1	Required	2semester								100	1				100
Liberal Arts Education	Basic language I	1	Elective	1semester-1T								100	1				100
Liberal Arts Education	Basic language II	1	Elective	1semester-2T								100	1				100
Liberal Arts Education	Area Courses Courses in Arts and HumanitiesNatural Sc	4	Elective	1,2,3,4semester	100	1											100
Liberal Arts Education	Area Courses Courses in Natural Sciences	4	Elective	1,2,3,4semester	100	1											100
Liberal Arts Education	Health and Sports Courses	2	Elective	1,2semester	100	1											100
Liberal Arts Education	Information and Data Science Courses	2	Required	1semester			100	1									100
Liberal Arts Education	CalculusI	2	Required	1semester			100	1									100
Liberal Arts Education	CalculusII	2	Required	2semester			100	1									100
Liberal Arts Education	Linear AlgebraI	2	Required	1semester			100	1									100
Liberal Arts Education	Linear AlgebraII	2	Required	2semester			100	1									100
Liberal Arts Education	Seminar in Basic Mathematics I	1	Required	1semester			100	1									100
Liberal Arts Education	Seminar in Basic Mathematics II	1	Required	2semester			100	1									100
Liberal Arts Education	General Mechanics I	2	Required	1semester			100	1									100
Liberal Arts Education	General Mechanics II	2	Required	2semester			100	1									100
Liberal Arts Education	Basic Electromagnetism	2	Required	3semester			100	1									100
Liberal Arts Education	Experimental Methods and Laboratory Work in Physics I	2	Required	2semester			100	1									100
Liberal Arts Education	General Chemistry	2	Elective	3semester			100	1									100
Liberal Arts Education	Experimental Methods and Laboratory Work in Chemistry I	2	Elective	2semester			100	1									100
Specialized Education	Applied Mathematics I	2	Required	2semester					100	1							100
Specialized Education	Applied Mathematics II	2	Required	3semester					100	1							100
Specialized Education	Applied Mathematics III	2	Required	4semester					100	1							100
Specialized Education	Engineering Mathematics A	2	Elective	5semester					100	1							100
Specialized Education	Engineering Mathematics C	2	Elective	4semester					100	1							100
Specialized Education	Probability and Statistics	2	Required	3semester					100	1							100
Specialized Education	Synthesis of Applied Mathematics	2	Elective	6semester					100	1							100
Specialized Education	Practice of Mechanics	1	Elective	2semester					100	1							100
Specialized Education	Introduction of Mechanical and Transportation Engineering	2	Required	2semester					100	1							100
Specialized Education	Technical English	1	Required	3semester					100	1							100
Specialized Education	Basic Engineering Computer Programming	2	Required	3semester		100	1										100
Specialized Education	Experiments in Mechanical Engineering	1	Required	5semester						80	1	20	1				100
Specialized Education	Fundamentals of Materials Processing	2	Required	3semester					100	1							100
Specialized Education	An Introduction to Engineering Materials																

Subject type	Class subjects	credits	Type of course registration	Period	Evaluation items										Total weighted values of evaluation items in the subject
					Knowledge and Understanding				Abilities and Skills				Comprehensive Abilities		
					(1)		(2)		(1)		(2)		(1)		
					Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	Weighted values of evaluation items in the subject	Weighted values of evaluation items	
Specialized Education	Mechanical Engineering Design and Production	1	Required	6semester							100	1			100
Specialized Education	Computer Programming	2	Elective	5semester			100	1							100
Specialized Education	Machine Shop Training (a)	1	Required	2semester							100	1			100
Specialized Education	Machine Shop Training (b)	1	Required	3semester							100	1			100
Specialized Education	Mechanical Materials I	2	Elective	5semester					100	1					100
Specialized Education	Mechanical Materials II	2	Elective	6semester					100	1					100
Specialized Education	Fracture Mechanics	2	Elective	6semester					100	1					100
Specialized Education	Fusion and Solidification Processings I	2	Elective	5semester					100	1					100
Specialized Education	Plastic Working and Powder Metallurgy II	2	Elective	6semester					100	1					100
Specialized Education	Materials Science	2	Elective	4semester					100	1					100
Specialized Education	Machining	2	Elective	5semester					100	1					100
Specialized Education	Fluid Dynamics II	2	Required	4semester-4T					100	1					100
Specialized Education	Heat Transfer I	2	Required	4semester-3T					100	1					100
Specialized Education	Combustion Engineering Fundamentals	2	Elective	5semester					100	1					100
Specialized Education	Internal Combustion Engines	2	Elective	6semester					100	1					100
Specialized Education	Data Processing and Numerical Analysis	2	Required	4semester					100	1					100
Specialized Education	Theory of Elasticity and Plasticity	2	Elective	5semester					100	1					100
Specialized Education	Computational Solid Mechanics	2	Elective	5semester					100	1					100
Specialized Education	Mechanics of Materials II	2	Elective	4semester					100	1					100
Specialized Education	Mechanism and Kinematics	2	Elective	4semester					100	1					100
Specialized Education	Dynamics of Vibrations II	2	Elective	5semester					100	1					100
Specialized Education	Control Engineering II	2	Elective	4semester					100	1					100
Specialized Education	Electrical and Electronic Engineering	2	Elective	5semester					100	1					100
Specialized Education	Mechatronics	2	Elective	6semester					100	1					100
Specialized Education	Measurement and Signal Processing	2	Required	6semester					100	1					100
Specialized Education	Mechanical System Control	2	Elective	5semester					100	1					100
Specialized Education	Manufacturing System	2	Elective	5semester					100	1					100
Specialized Education	Machine Design	2	Elective	6semester					100	1					100
Specialized Education	Systems Engineering	2	Elective	4semester					50	1	50	1			100
Specialized Education	Machine Elements Design	2	Elective	4semester					100	1					100
Specialized Education	Internship	1	Elective	6semester	40	1					30	1	30	1	100
Specialized Education	Elementary Electromagnetism	2	Required	4semester					100	1					100
Specialized Education	Introduction to Quantum Physics	2	Required	4semester					100	1					100
Specialized Education	Compressible Fluid Dynamics	2	Elective	5semester					100	1					100
Specialized Education	Fluid Machinery	2	Elective	semester					100	1					100
Specialized Education	Thermodynamics II	2	Elective	semester-4T					100	1					100
Specialized Education	Statistical and Thermal Physics	2	Elective	semester					100	1					100
Specialized Education	Heat Transfer II	2	Elective	5semester					100	1					100
Specialized Education	Steam Power	2	Elective	6semester					100	1					100
Specialized Education	Plasma Engineering	2	Elective	5semester					100	1					100
Specialized Education	Radiation Engineering	2	Elective	5semester					100	1					100
Specialized Education	Nuclear Engineering	2	Elective	6semester					100	1					100
Specialized Education	Optical Measurement Techniques	2	Elective	6semester					100	1					100
Specialized Education	Natural Energy Utilization Engineering	2	Elective	6semester					100	1					100
Specialized Education	Transportation	2	Elective	semester-4T					100	1					100
Specialized Education	Graduation Thesis	5	Required	7,8semester							55	1	45	1	100

# Curriculum Map of Energy Transform Engineering

## Sheet

Spring	Fall	Spring	Fall	Spring	Fall
Introduction to University Education	Area Courses	Area Courses	Area Courses	Reliability Engineering △	Internship
Peace Science Courses	Health and Sports Courses				
Area Courses					
Health and Sports Courses					
Introduction to Information and Data Sciences ○	CalculusII	Basic Electromagnetism			
CalculusI (◎)	Linear AlgebraII	General Chemistry ○			
Linear AlgebraI (◎)	Seminar in Basic Mathematics II	Basic Engineering Computer Programming			
Seminar in Basic Mathematics I (◎)	General Mechanics II				
General Mechanics I (◎)	Experimental Methods and Laboratory Work in Physics I				
	Applied Mathematics I	Applied Mathematics II	Applied Mathematics III	Engineering Mathematics A	Synthesis of Applied Mathematics
	Practice of Mechanism	Probability and Statistics	Engineering Mathematics C	Computer Programming ○	Dynamics of Vibrations II
	Introduction of Mechanical and Transportation Engineering	Mechanics of Material I	Dynamics of Vibrations I	Mechanical Materials I	Fracture Mechanics
	Machine Design and Drawing	Thermodynamics I	Materials Science	Fusion and Solidification Processings I	Plastic Working and Powder Metallurgy II
		Fluid Dynamics I	Elementary Electromagnetism	Machining	Statistical and Thermal Physics
		Control Engineering I	Introduction to Quantum Physics	Heat Transfer II	Internal Combustion Engines
		An Introduction to Engineering Materials ◎	Fluid Dynamics II	Combustion Engineering Fundamentals	Mechatronics
		Fundamentals of Materials Processing	Thermodynamics II	Plasma Engineering	Optical Measurement Techniques
			Heat Transfer I	Theory of Elasticity and Plasticity	Machine Design
			Data Processing and Numerical Analysis ◎	Dynamics of Vibrations II	Fluid Machinery
			Mechanics of Materials II	Electrical and Electronic Engineering	Internal Combustion Engines
			Mechanism and Kinematics	Mechanical System Control	Steam Power
			Control Engineering II	Manufacturing System	Radiation Engineering △
			Machine Elements Design-○	Compressible Fluid Dynamics	Nuclear Engineering
			Systems Engineering	Computational Solid Mechanics ( )	Measurement and Signal Processing ◎
			Transportation ○		
Introductory Seminar for First-Year Students	Machine Shop Training (a) ◎	Machine Shop Training (b) ◎	Systems Engineering	Experiments in Mechanical Engineering ◎	Mechanical Engineering Design and Production
		Computer Aided Design			Internship
Introductory Seminar for First-Year Students	Basic English UsageII			Experiments in Mechanical Engineering ◎	Internship
					Graduation Thesis
					Graduation Thesis