



while maintaining a global perspective. Therefore, developing professionals who can approach these environmental issues from a chemical engineering perspective is one of the objectives of this program.

Students who are enrolled in Cluster 3 (applied chemistry, biotechnology, chemical engineering) at the School of Engineering receive the common education for Cluster 3 by the end of the first semester of the second year, and are registered in this program from the second semester of the second year. From that point until graduation, under the integrated educational system, students can acquire expertise in chemical engineering to the level needed to pass the examination of Associate Professional Chemical Engineer.

Many of the graduates advance to graduate school and acquire a higher level of expertise and research capabilities. They often find employment with corporations working in areas such as chemicals, ceramics, textiles, medical products, foods, paper making, and other chemical-related industries, and they also gain employment with electricity, metals, machinery, construction, and food companies, energy and environment-related corporations, and in various other industrial areas. They work actively inside and outside the country, using their chemical engineering knowledge as their weapon. In addition, this program was approved in 2004 by the JABEE (Japan Accreditation Board for Engineering Education) for chemistry, chemistry-related fields, and chemical engineering courses. It also received an ongoing certification review in 2009, and was accredited in terms of educational activities, educational

### 3. Academic Awards Policy (Goals of the Program and Policy for Awarding Degrees)

Chemical engineering is the academic system of engineering needed when making use of chemistry in real life. In -discovered or synthesized highly functional substances in real life, it is necessary to efficiently produce the needed quantity of these industrial products at a reasonable price. Therefore, we must make effective use of limited resources and energy, while minimizing the burden on the environment, and select or develop the most efficient production system. Chemical engineering is the academic system that brings together development of the optimal production system, and design and operational management of new plants and equipment.

This program develops professionals who have acquired the fundamentals of, and professional expertise in, chemical engineering, through education and research into the efficient use of substances, energy and reaction processes. It also develops professionals who are able to approach environmental problems from the perspective of chemical engineering. Therefore, the program sets the goals (A) to (E) below, and cultivates not only professional expertise in engineering in general, and chemical engineering in particular, but also the essential foundation indispensable for engineers and researchers, which includes creativity, communication skills, and the like. This

necessary to meet the standard of the course, and have achieved the following goals.

- (A) Acquisition of a multiple thinking ability and understanding of relations among human, society, nature, and engineering. (engineering ethics)
- (B) Acquisition of logical thinking ability
- (C) Acquisition of basic chemistry and chemical engineering and cultivation of application ability
- (D) Acquisition of flexible adapting ability and creativity and cultivating motivation for self-development and self-improvement
- (E) Acquisition of presentation and communication ability and cultivation of application ability to high informatization.

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

Cultivation of an understanding of the impact that technology has on society and nature, and the responsibility that engineers have towards society, as well as cultivation of the ability to think multilaterally, from a global perspective, about the relationship between engineering, people, society, and the natural environment. This is achieved through the study of liberal arts education subjects such as

an Recycling Engineering

(B) Cultivation of logical thinking ability.

Acquisition of basic knowledge about natural science, such as mathematics and physics, and acquisition of basic knowledge about technology, as well as the reinforcement of logical thinking skills based on the acquired basic knowledge, is achieved through the study of foundation courses in liberal arts education such as the experiment-

Laborat

Basic Electromagnetism .

(C) Cultivation of basic chemistry and chemical engineering, and cultivation of application ability.

Cultivation of basic academic ability in engineering through a systematized and carefully selected educational curriculum, and cultivation of professional expertise and applied skills. Particularly, by focusing on exercises and experiments, aiming at acquisition of specialized subjects in chemical engineering that enable students to acquire the ability to become independent engineers and to acquire the basics needed to engage in advanced research in graduate school. Furthermore, cultivation of a high level of consciousness as engineers through plant tours and practical work related to chemical plant design, and through lectures by external instructors with rich, real-life business experience. Abilities are cultivated by focusing on the following five fields in achieving Goal (C) in this program.

(C1) Engineering basis

Cultivation of knowledge about basic engineering such as applied mathematics, information processing • calculator utilization technology, basic chemistry, environmental science, material science, material mechanics, and cultivation of problem-

Elements of Information Literacy or Exercise in Information

Literacy

Basic Organic Chemistry

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(C2) Chemical engineering basis

Cultivation of professional expertise such as chemical stoichiometry including mass and energy balance, thermodynamics including physics and chemical equilibrium, theory of transport phenomena such as heat, mass, and momentum, and cultivation of experimental technology and ability that can be used for solving a problem by

Thermodynamic

Exercise of Chemical Engineering Thermodynamics .

(C3) Chemical basis

Acquisition of basic knowledge of chemical fields such as organic chemistry, analytical chemistry, reaction engineering, polymer chemistry, electrochemistry, biochemistry, and energy chemistry, as well as basic knowledge of fields related to chemistry and experimental techniques, and the cultivation of abilities to utilize them for solving

Inorganic Chemistry

(C4) Chemical engineering field

Acquisition of expertise in chemical engineering fields such as heat transfer, fluids engineering, material transfer, reaction engineering, process control engineering, powder technology, drafting and design, and experimental tec

Chemical Engineering Exercise and Experimental

Chemical Engineering

(C5) Chemical engineering application

Cultivation of management abilities and the ability to study, develop, and design the substances and energy processes that consider material circulation and environmental burdens while taking account of economy, safety,

(D) Cultivation of flexible adapting ability and creativity and cultivating motivation for self-development and self-improvement.

Cultivation of creativity, problem-solving abilities, and motivation for self-development and study, by actually engaging in engineering while coming into contact with people who have different ideas during experimentation, chemical process design, graduation work. This is achieved by completing

(E) Improvement of presentation and communication ability and cultivation of application ability to high informatization.

Reinforcement of the ability to write, present, and engage in discussion logically through liberal arts seminars, experiment subjects, chemical process design, and graduation work, as well as cultivation of the ability to collect and transmit information in the fields of engineering from an international perspective through promotion of technical English. In addition, cultivation of the ability to utilize information through thorough information literacy education by

Elements of Information Literacy or Exercise in

Information Literacy

Program of Chemical Engineering



(D)  Cultivation of flexible adapting ability and creativity and cultivating motivation for self-development and self-improvement

(E) Improvement of presentation and communication ability and cultivation of application ability to high informatization.

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## (2) Program assessment

### program assessment

This program evaluates and improves the program in PDCA cycles from the following evaluation perspectives.

- (1) Whether goals being set are appropriate
- (2) Whether the amount of learning (learning hours) is sufficient
- (3) Whether curricula being set are appropriate
- (4) Whether classes are conducted in accordance with the syllabus
- (5) Whether equipment and facilities are sufficient
- (6) Whether the student support system is sufficient
- (7) Whether the goal attainment levels are sufficient
- (8) Whether educational improvement is undertaken
- (9) Whether continuous improvement is undertaken
- (10) Whether the records of activities are publicized or disclosed

The Educational Evaluation Committee, the Student Evaluation Committee, the Educational Improvement Committee, and the Managing Committee evaluate this program on a daily and continuous basis, in a planned manner, from the above-mentioned evaluation perspectives. Therefore, the committees prepare unique questionnaires, grade summary sheets, and the survey on attainment levels, and put them into action. (Major evaluation perspectives and when to implement evaluation are described.)

- Class questionnaires to evaluate the amount of learning (learning hours), class accordance with the syllabus, attainment levels against the goals (class improvement questionnaires targeting students and staff)
  - for educational improvement, improvement reports by teacher in charge of subjects (implemented at the end of each semester)
- Questionnaires to evaluate the validity of the goals and suitability of the established curriculum, the questionnaires at the time immediately after presenting graduation theses), the questionnaires targeting graduates and their superiors (conducted once every three years, for graduates who graduated 3, 4, or 5 years ago)
- The amount of learning (learning hours), class accordance with the syllabus, grade summary sheet for each class subject to evaluate the attainment levels against the goals, attendance record (conducted at the end of each semester)
- Drawing up of program syllabus (once a year)
  - results of individual students and of the entire grade (conducted at the end of each semester)
- FD activities, such as class observations of all staff (conducted on a regular basis)

The Educational Evaluation Committee, the Student Evaluation Committee, and the Educational Improvement Committee gather the above data according to each task, and compile the results of various questionnaires, academic results of class subjects and comprehensive evaluations, and attainment levels against the goals. The

improvement reports by the teacher in charge of each subject. The Managing Committee that oversees the three committees discusses these ideas in comprehensive way and draws up the final evaluation and ideas for improvement. Evaluation and improvement plans, and items decided here, are discussed at the meeting of staff in charge, to disseminate to all staff in charge of the programs and to gain their approval. Furthermore, the



As for the suitability of the evaluation methods of attainment levels, and of the evaluation criteria from the point of view of society, the Program Evaluation Committee, which is an external evaluation committee held once a year, gives its evaluation.

These activities are conducted on a daily and continuous basis in a planned manner. The outcome and the activity records of each committee are shared by all faculty members of this program.

k to students

To improve student education, this program has introduced a new system for tutors and various questionnaires.

academic results a

in a position to identify improvements. Based on this, by conducting interviews with individual students, this program promotes improvement of student education in close consultation with the Managing Committee. By asking of the staff in charge of subjects at a class for comments about the questionnaire, based on the results of the class improvement questionnaires completed by students, or on the class check and evaluation results given by the students, we make improvements of the lecture

comments on the questionnaire are made public to students, so that students are able to understand how the questionnaires are utilized for class improvement.

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## Cluster 3 Specialized Subjects (Program of Chemical Engineering)

⊙ Required subjects  
○ Compulsory Elective subjects

Class Subjects	Credits	Type of course registration	Class Hours/ Week																Note
			1st grade				2nd grade				3rd grade				4th grade				
			Spring		Fall		Spring		Fall		Spring		Fall		Spring		Fall		
			1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	
Experimental Chemical Engineering	3	⊙											9	9					
Chemical Equipment Design and Practice	2	⊙									4	4							
Fluids Engineering	2	⊙									4								
Heat Transfer	2	⊙											4						
Mass Transfer	2	⊙									2	2							
Chemical Engineering Thermodynamics	2	⊙									2	2							
Chemical Reaction Engineering	2	⊙											4						
Powder Technology	2	⊙									4								
Chemical Process Design	3	⊙													6	6			
Chemical Engineering Fundamentals	2	⊙							2	2									
Mechanics of Materials	2	○										4							
Chemical Engineering Exercise I	2	○							4	4									
Chemical Engineering Exercise II	2	○									4	4							
Chemical Engineering Exercise III	2	○											4	4					
Exercise of Chemical Engineering Thermodynamics	1	○									2	2							
Mathematics for Chemical Engineers	2	○							4										
Materials Science	2	○								4									
Process Control Eng.	2	○										4							
Numerical Calculation Method	2										4								
Chemical Process and Engineering Ethics	2	⊙													6				
Chemical Industrial Process	2														6				
Corrosion and Protection of Materials	2												4						
Green Technology	2													4					
Recycling engineering	2	⊙												4					
Inorganic Chemistry	2										4								
Physical Chemistry II	2	⊙							4										
Chemical Kinetics	2											4							
Synthetic Polymer Chemistry	2										4								
Electrochemistry	2												4						
Biochemistry II	2								4										
Fermentation Technology	2										4								
Biotechnology	2												4						
Graduation Thesis	5	⊙																	

Academic Achievements in Chemical Engineering  
The Relationship between Evaluation Items and Evaluation Criteria

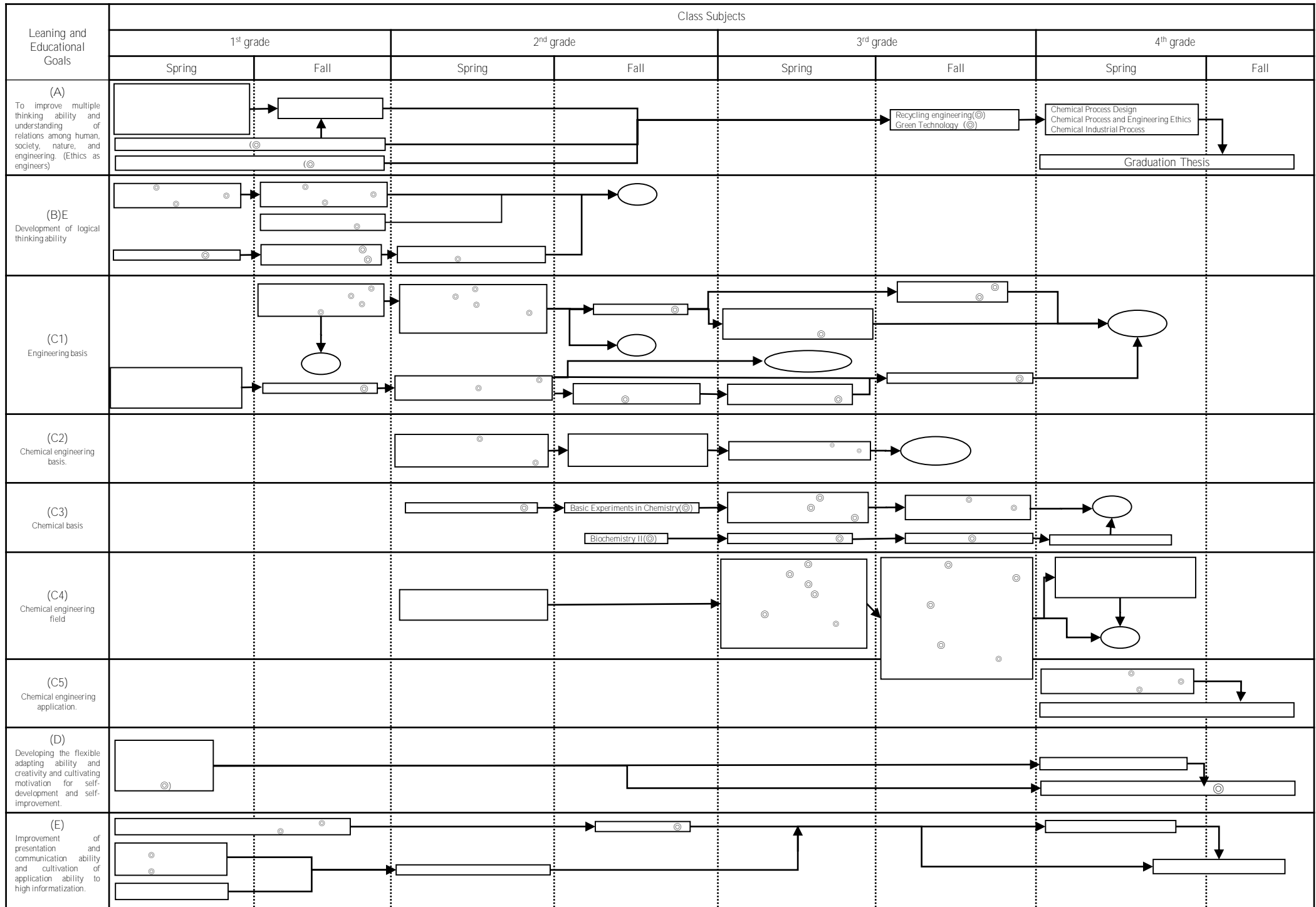
Academic Achievements		Evaluation Criteria		
Evaluation Items		Excellent	Very Good	Good
Knowledge and Understanding	(A) To improve multiple thinking ability and understanding of relations among human, society, nature, and engineering.	Sufficient understanding of relations among human, society, nature, and engineering. Acquiring sufficient thinking ability with multiple perspectives.	Good understanding relations among human, society, nature, and engineering deeply. Acquiring thinking ability with multiple perspectives.	Understanding relations among human, society, nature, and engineering.
	(B) Development of logical thinking ability	Acquiring an excellent logical thinking ability.	Acquiring a good logical thinking ability .	Acquiring a logical thinking ability.
Abilities and Skills	(C1) Definite learning of basic chemistry and chemical engineering and cultivation of engineering basis.	Sufficiently learned basic chemistry and chemical engineering and the applied skills.	Learned basic chemistry and chemical engineering.	Well learned basic chemistry and chemical engineering and the applied skills.
	(C2) chemical engineering basis			
	(C3) chemical basis.			
	(C4) chemical engineering field			
	(C5) chemical engineering application			
Overall Abilities	(D) Developing the flexible adapting ability and creativity and cultivating motivation for self-development and self-improvement	Acquiring excellent flexibility and creativity; also to have a willingness for self-improvement and self-enlightenment.	Acquiring good flexibility and creativity; also to have a willingness for self-improvement and self-enlightenment.	Acquiring flexibility and creativity; also to have a willingness for self-improvement and self-enlightenment.
	(E) Improvement of presentation and communication ability and cultivation of application ability to high informatization.	Developed presentation and communication ability very well. Acquired application ability to high informatization very well.	Developed presentation and communication ability well. Acquired application ability to high informatization well.	Developed presentation and communication ability. Acquired application ability to high informatization.

Placement of the Liberal Arts Education in the Major Program

Liberal Arts Education in this program assumes the role of establishing the academic foundation on which the specialized education will be built. It respects a voluntary, self-reliant attitude and cultivates scientific thinking based on information gathering abilities, analytical abilities, and critical thinking abilities. It establishes perspectives that make it possible to provide insight on the inner nature of things and their background from a wide broad viewpoint, and enhances linguistic abilities to the level appropriate for living as a global citizen. It also strengthens interest in peace, and integrates a broad range of knowledge into a body of knowledge that will be truly useful in solving problems. It cultivates the ability to explore and promote cross-disciplinary /comprehensive research that goes beyond the established frameworks.







Note : Subjects with (©) symbol have direct relation with next subject, and the subjects without symbol are incidentally influence.