

## Educational purpose

To develop global human resources with the extensive knowledge needed to realize a sustainable society, and having specialties from the basics to applications of science and technology, flexibility in thinking, competencies for intellectual creativity with problem finding and solving skills, broad perspectives, enriched sense of humanity, and collaboration skills to work in teams, all with a view to contributing to the international society.

College of Mathematics

College of Physics

College of Chemistry

College of Engineering Sciences

College of Engineering Systems

College of Policy and Planning Sciences

Bachelor's Program in Interdisciplinary Engineering

# College of Chemistry

## ■ Bachelor of Science

### ■ Educational purpose ■

We foster personnel with basic and extensive chemistry knowledge necessary for: (i) the pursuit of universal principles in the natural world as well as unknown substances and unknown phenomena; (ii) the creation of functional substances and materials development; (iii) the solution of environmental problems and energy problems; and (iv) the elucidation of life phenomena at the molecular level. Based on this, we aim to develop students with flexible ways of thinking backed by the aforementioned knowledge and understanding who are able to play vigorously active roles internationally.

### ■ Desired students ■

Personnel with sufficient academic abilities related to chemistry and basic academic skills in the associated fields who are motivated to pursue universal principles in the natural world and seeking new substances and unknown phenomena are desired.

## Measures to ensure and improve the quality of education

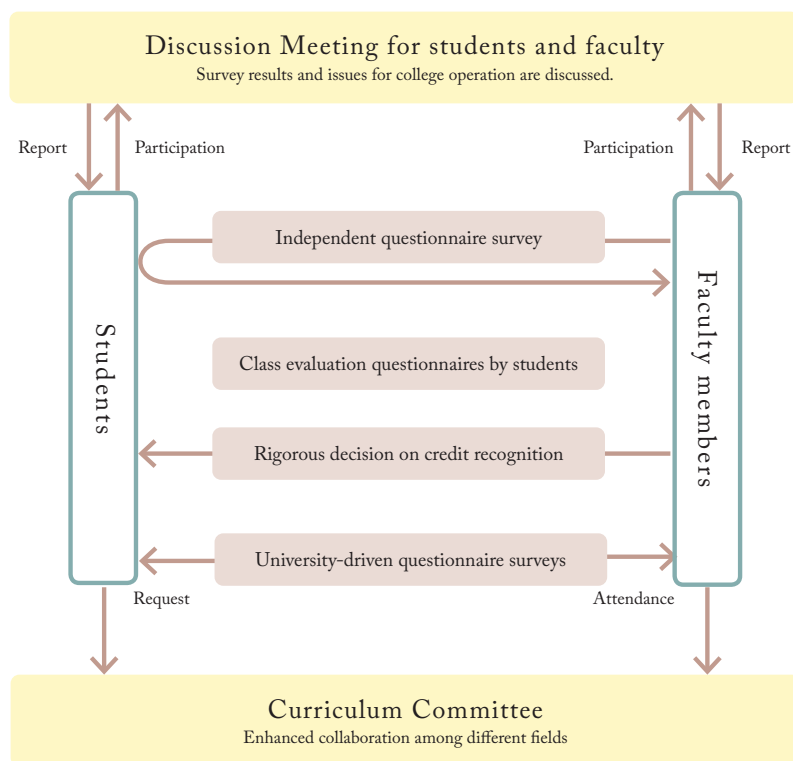
Every year, class questionnaire evaluations are conducted independently by students and by the university. The results of these surveys, along with other issues for college operation, are discussed at the discussion meetings, where students and faculty members gather together. The minutes of these meetings are published in the form of an annual report.

The instructor of each course carries out his/her own survey and uses the results to improve educational effects.

Results of the questionnaires above and other data are used to review the class contents and link between courses for each field of chemistry (inorganic chemistry, organic chemistry, and physical chemistry) as needed. In addition, the Curriculum Committee works to strengthen links among different fields.

The results of final exams and reports are comprehensively evaluated for rigorous decision on credit recognition.

### Discussion meetings for students and faculty, and the Curriculum Committee



# Bachelor of Science

## Diploma Policy

We grant diplomas for Bachelor of Science to persons who have acquired the knowledge and abilities (that is, Generic Competences) required based on the educational purpose for undergraduate students of the University of Tsukuba. In their learning outcomes, they will achieve the following goals based on the educational purpose of our school and college.

Students have acquired basic knowledge in natural science and scientific thinking methods.

(Relevant competences: 1 Knowledge and understanding of basic chemistry, 2 Knowledge and understanding of, and ability to apply, inorganic and analytical chemistry, 3 Knowledge, understanding, and application of the fields of thermodynamics and statistical, 4 Knowledge and understanding of the fields of quantum chemistry and spectroscopy and the ability to apply, 5 Knowledge and understanding of the field of organic chemistry and the ability to apply them, 6 Knowledge and understanding of the field of biochemistry and the ability to apply them, 7 Ability to carry out chemical experiments)

Students have understood substances at the level of molecular, atomic, electronic, and chemical bonding states.

(Relevant competences: 1 Knowledge and understanding of basic chemistry, 2 Knowledge and understanding of, and ability to apply, inorganic and analytical chemistry, 3 Knowledge, understanding, and application of the fields of thermodynamics and statistical, 4 Knowledge and understanding of the fields of quantum chemistry and spectroscopy and the ability to apply, 5 Knowledge and understanding of the field of organic chemistry and the ability to apply them, 6 Knowledge and understanding of the field of biochemistry and the ability to apply them)

Students have basic chemistry knowledge necessary for: (i) pursuing universal principles in the natural world as well as unknown substances and unknown phenomena; (ii) creation of functional substances and materials development; (iii) solution of environmental problems and energy problems; and (iv) elucidation of life phenomena.

(Relevant competences: 1 Knowledge and understanding of basic chemistry, 2 Knowledge and understanding of, and ability to apply, inorganic and analytical chemistry, 3 Knowledge, understanding, and application of the fields of thermodynamics and statistical, 4 Knowledge and understanding of the fields of quantum chemistry and spectroscopy and the ability to apply, 5 Knowledge and understanding of the field of organic chemistry and the ability to apply them, 6 Knowledge and understanding of the field of biochemistry and the ability to apply them, 7 Ability to carry out chemical experiments)

Based on basic and essential knowledge about chemistry as mentioned above, students have flexible ways of thinking backed by the aforementioned knowledge and understanding, and they are able to play vigorously active roles internationally. (Relevant competences: 1 Knowledge and understanding of basic chemistry, 8 Ability to understand and express chemical English)

Students are able to solve chemistry-related problems through cooperation with other people.

(Relevant competences: All of the Specific Competences)

## Curriculum Policy

We organize and implement curricula based on the following policies for programs that allow students to acquire learning outcomes related to Bachelor of Science.

### General policy

We organize and implement a curriculum that allows students to move from basic knowledge to specialized knowledge so as to foster a chemistry specialty over four years. We offer class subjects with a central focus on lectures and experiments. We also provide seminar subjects that allow students to proactively engage in learning activities and a Graduation Project and Thesis for fostering comprehensive abilities related to chemistry.

### Course sequence policy

During the first year, we offer education with a central focus on lectures so that students acquire basic knowledge related to overall natural science and basic knowledge for learning specialized chemistry.

During the second year and the third year, in order for students to acquire extensive chemistry knowledge and techniques from the basic level to the specialized level, we offer practical training sessions and seminars according to systematic lectures and the progression of lectures in specialized chemistry. Moreover, in order to acquire abilities for reaching international chemical information, we provide lectures related to chemistry English.

During the fourth year, in order for students to learn knowledge about advanced chemistry and learn methods for uncovering relevant information concerning chemistry research and international chemistry information for inquiries into the truth, students engage in the Graduation Research and Thesis.

### Implementation policy

We offer well-balanced lectures for Basic Chemistry and Advanced Chemistry so that the level of chemistry increases sequentially according

to the year. In order to acquire experimental methods for understanding natural phenomena, we implement practical training sessions.

In order for students to obtain the research methods that allow them to elucidate the truth about nature and unknown phenomena, we have a graduation project and thesis.

We offer chemistry lectures in English so students obtain English proficiency, which is internationally necessary in the field of chemistry.

#### Policy for evaluation of learning outcomes

We set achievement goals for each class subject,

and comprehensively evaluate achievement in lectures through final tests, quizzes, reports, presentations, etc., and in practical training through reports, attitudes toward experiments, questions and answers, etc.

#### Characteristics

In order to obtain deeper understanding of what is learned in lectures, students take specialized Advanced Chemistry Laboratory courses in their third year, where focus is placed not only on theory but also on acquisition of experimental methods.

Educational Plan				
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year
Major Subjects		Chemistry Laboratory	Advanced Chemistry Laboratory	Graduation Research
Foundation Subjects for Major				
General Foundation Subjects	Common Foundation Subjects, Specific Foundation Subjects			
	Basic knowledge related to overall natural science	A wide range of knowledge and skills in chemistry from basic to expertise		Knowledge in advanced chemistry
	Basic skills for studying advanced chemistry	Abilities to understand global information in chemistry		Methods for chemical research and global information search in chemistry

Subjects in College of Chemistry				
	1 <sup>st</sup> year	2 <sup>nd</sup> year	3 <sup>rd</sup> year	4 <sup>th</sup> year
	Introduction to Chemistry Chemistry 1 Chemistry 2 Chemistry 3 Basic Chemistry Seminar	Inorganic Chemistry I Analytical Chemistry Physical Chemistry I • II Organic Chemistry I • II Biochemistry Basic English in Chemistry Chemistry Laboratory Chemistry Laboratory II	Inorganic Chemistry II Chemistry of Inorganic Elements Nuclear Chemistry Molecular Structure Analysis Physical Chemistry III • IV Organic Chemistry III • IV Seminar in Advanced Chemistry Advanced Chemistry Laboratory I • II Advanced Reading of Foreign Literature in Chemistry	Graduation Research Advanced Lecture in Inorganic Analytical Chemistry Advanced Lecture in Physical Chemistry Advanced Lecture in Organic Chemistry Advanced Lecture in Biomolecular Chemistry
Common Foundation Subjects	Multidisciplinary Subjects, English Information Literacy Physical Education	Multidisciplinary Subjects Physical Education	Computational Chemistry	Bioorganic Chemistry