## For entrants in AY 2023

Appended Form 1
Specifications for Major Program
Name of School（Program）〔School of Engineering Cluster 3 （Applied Chemistry，Biotechnology and Chemical Engineering）］

| Program name（Japanese） | 生物 |
| :--- | :--- |
| （English | Prog |
| 1．Academic Degree to be Acquired |  |
| Bachelor＇s degree in engineering |  |

## 2．Overview

In order to contribute to the advancement of the key industries that will play a role in the next generation，such as medicine，food，and environment，this program aims at developing engineers and researchers that possess professional expertise and technical skills in the elucidation and utilization of biological molecules and living organisms．Therefore，this program establishes a curriculum through which students can organically and systematically acquire comprehensive knowledge of the basic mechanisms of life and technical skills in the most－ advanced fields，such as gene，protein，carbohydrate，and lipid engineering；microorganism，animal，and plant engineering；biochemical engineering；bioinformatics engineering；environmental biotechnology；immunology；and brewing technology．Students can also acquire the different abilities required for researchers and engineers，such as the ability to think logically，the ability to plan and conduct experiments，the ability to explain data analysis，the ability to discover and resolve the problems，and the ability to deal with practical issues．This program awards the Type－1 High School Teaching License（Industry）to students who have taken the required courses．Graduates gain employment and work actively for corporations in the pharmaceutical，food，brewing，environmental，and chemical industries，or in public research institutions．Graduates can go to graduate school（Graduate School of Integrated Sciences for Life）to obtain a higher degree of education and undertake research．

## 3．Academic Awards Policy（Policy for awarding degrees and goal of the program）

The Program of Biotechnology nurtures professionals that have acquired the basic knowledge，skills，and attitudes needed to work as bioengineering researchers and engineers and，further，to embrace opportunities for creativity in scientific thought．

Therefore，this program offers education aimed at cultivating a broad range of general knowledge，a global perspective to seek peace，a general sense of judgment，and a well－rounded character．The program awards a bachelor＇s degree in engineering to students who have completed sufficient liberal arts education and specialized education to achieve the following goals from（A）to（E），as well as the number of credits necessary to meet the standard of the course．
（A）The ability to understand the relationship between people，society，nature，and engineering，and to demonstrate multifaceted and logical thinking skills
（B）The ability to understand basic natural science
（C）The ability to acquire basic knowledge of biotechnology and biological science，and to expand it widely to applied technology
（D）The ability to come up with conceptual ideas and to implement ideas，as well as the ability to transmit learning and research results
（E）The ability to adapt to the highly sophisticated information society with high level communication skills

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

To achieve the goals from (A) to (E) set by this program, the Program of Biotechnology organizes and implements a curriculum in which liberal arts education and specialized education are closely connected. After acquiring basic academic abilities and knowledge in liberal arts education subjects, students must learn the specialized fields of engineering and biotechnology. Students mainly study these subjects until the first and second terms of the second year, and then after the third and fourth terms of the second year, when students are assigned to the program, they mainly study specialized subjects. Learning specialized basic subjects before being assigned to the program is effective in raising awareness of students' field of specialization, and in developing incentives for learning. Furthermore, receiving lectures by the faculties in charge of programs other than the Program of Biotechnology (Program of Chemical Engineering,Program of Applied Chemistry) provides students with knowledge about surrounding fields.

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.

## Knowledge and Abilities

- Cultivation of understanding about the relationship between people, society, nature, and engineering, as well as an ethical outlook, which forms the basic knowledge that researchers and engineers are required to possess (Goal A). This is obtained through mastery of liberal arts education subjects, "Introductory Seminar for First-Year Students", "Peace Science Courses" ,"Introduction to University Education", "Information Subjects" and specialized basic subjects, " Introduction to Applied Chemistry, Chemical Engineering and Biotechnology", and " Introduction to Fundamental Industry" to be offered at the first year.
- Basic knowledge of mathematical theory, physics theory, and experimental methods required of researchers and engineers in natural science (Goal B). This is obtained through mastery of mathematical fundamental subjects such as "Calculus" and "Linear Algebra" and fundamental physics subjects such as "General Mechanics I•II" and "Experimental Methods and Laboratory Work in Physics" to be offered in the first year.
- General understanding of biotechnology, life science, chemistry, and the basic knowledge required of experts in biotechnology (Goal B, C). This is obtained through mastery of specialized basic subjects, "Basic Life Science", "Basic Organic Chemistry l", "Basic Inorganic Chemistry" and "Basic Environmental Sciences" to be offered in the first year.
- Mathematical method required of experts in biotechnology (Goal B). This is obtained through mastery of specialized basic subjects, "Applied Mathematics I•II", and "Probability and Statistics" to be offered from the third and fourth term of the first year through the second year.
- The expertise and grasp of concepts required of researchers and engineers in biotechnology (Goal C). This is obtained through mastery of the specialized subjects of the Program of Biotechnology such as "Microbiology I• II", "Molecular Biology I • II • III", "Enzyme Chemistry", and "Biochemical Engineering" to be offered from the third and the fourth term of the second year through the fourth year.


## O Abilities and Skills

- The ability to conduct experiments to resolve issues and problems that arise, and the ability to examine and resolve problems using experimental outcomes and related materials (Goal C, D, E). This is obtained through mastery of experimental subjects closely related to biotechnology, such as "Experimental Methods and Laboratory Work in Biology", "Basic Experiments in Chemistry", and "Training of Biotechnology I • II"
- The ability to make action plans on one's own initiative in response to practical issues and challenges, to make adjustments, and to resolve problems and challenges by using basic and specialized knowledge and methods (Goal C, D, E). These are obtained through mastery of "Graduation Thesis" to be offered in the fourth year.


## O Overall Abilities

- The ability to organize and analyze information from the literature to discover and resolve practical problems and challenges, and the ability to logically make research plans and carry them out (Goal C, D, E). These are obtained through mastery of "Group Discussion of Current Biotechnology Topics" to be offered in the third year and "Graduation Thesis" to be offered in the fourth year.
- The ability to organize research results and write logically, including about the significance and validity of the obtained outcome, and to prepare presentation data, present it, and discuss it verbally in an easy-to-understand manner (Goal E). These are obtained through mastery of "Group Discussion of Current Biotechnology Topics" to be offered in the third year, and "Graduation Thesis" to be offered in the fourth year.
- Teamwork ability, leadership ability, and communication ability in group work (Goal E). These are obtained through mastery of "Basic Experiments in Chemistry", and "Training of Biotechnology I•II" to be offered from the third and fourth term of the second year though the third year, and through "Group Discussion of Current Biotechnology Topics" to be offered in the third year.
- The ability to read, write, and converse in the English language necessary for conducting research (Goal E). This is obtained through mastery of "Communication Basic •I•II" in the liberal arts education subjects, "Technical English" to be offered in the third and the fourth terms of the second year, and "Graduation Thesis" to be offered in the fourth year.

5. Program Timing and Acceptance Conditions

- When to start the program:

The second semester of the second year
Cluster 3 offers distinctive education that organically integrates fields related to chemistry, biotechnology, and processes. Specifically, it aims at developing professionals that possess a wide range of basic knowledge about the development of new functional substances and materials, the biotechnology of plants, animals, and microbes, the design and control of chemical process, environmental preservation and bioremediation, and the development of resources and energy, as well as having a high level of expertise and technical skill in a harmonious way. To achieve this aim, in addition to the common subjects and a wide range of specialized basic education, three programs are prepared that provide specialized education about chemistry, biotechnology and processes. These are the Program of Applied Chemistry, the Program of Biotechnology, and the Program of Chemical Engineering. Registration to these three programs is to be made in the second semester of the second year, so that students are able to choose the suitable specialized field or program while acquiring a wide range of specialized basic knowledge.

- Requirements of Acquired Credits

In order to be assigned to each program, students must acquire 16 or more credits out of a total of 18 credits in compulsory specialized basic subjects (excluding Basic Chemical Experiment and Technical English) and must acquire an overall total of 60 or more credits (including in liberal arts education subjects).

## - Program Quota

An upper limit is set for acceptance of students. Assignment to the Program of Applied Chemistry, the Program of Biotechnology and the Program of Chemical Engineering is decided after taking into account the requests of students and their academic results.

## 6. Qualifications to be Acquired

- Type-1 High School Teaching License (Industry) (By mastering "Vocational Guidance", the prescribed "liberal arts education subjects" and "specialized education subjects", students can obtain the Type-1 High School Teaching License (Industry) upon graduation.)

Details are described in the student handbook and guidance materials.

## 7. Class Subjects and Course Content

* For class subjects, see the subject list in the attached Tables 1 and 2.
(Subject list to be attached.)


## 8. Academic Achievements

At the end of each semester, evaluation criteria are applied to each evaluation item and indicate academic achievement by indicating the attainment level. Students' grade calculations for each subject, from admission to the university until the current semester, is given as one of the 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 achievements $(S=4, A=3, B=2$, and $C=1)$ in each subject being evaluated.

| Result Evaluation | Conversion |
| :---: | :---: |
| S $\quad(90$ points or more $)$ | 4 |
| A $\quad(80 \sim 89$ points $)$ | 3 |
| B $\quad(70 \sim 79$ points $)$ | 2 |
| C $\quad(60 \sim 69$ points $)$ | 1 |


| Academic Results | Standard |
| :--- | :---: |
| Excellent | $3.00 \sim 4.00$ |
| Very Good | $2.00 \sim 2.99$ |
| Good | $1.00 \sim 1.99$ |

* See the relationship between evaluation items and evaluation criteria in the attached sheet 2.
* See the relationship between evaluation items and class subjects in the attached sheet 3.
* See the curriculum map in the attached sheet 4.

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

Students receive practical guidance through graduation work in a research laboratory where world-leading research is conducted in various fields of biotechnology, and acquire a fundamental capability as bioengineering researchers and engineers.

Students are to be assigned at the start of the fourth year. As requirements for undertaking a graduation thesis, students must acquire 8 credits in foreign languages and must have completed all experiment subjects and practical subjects to be taken. Furthermore, students must acquire a total of 115 or more credits (including liberal arts education subjects) including a total of 69 or more credits in specialized basic subjects and specialized subjects. (Refer to the attached Table 1 and Table 2)
10. Responsibility System
(1) PDCA Responsibility System ("Plan," "Do," "Check," and "Act")

The Educational Evaluation Committee (in charge of examining and handling the faculties' evaluation of the curriculum and the content of lectures), The Student Evaluation Committee (in charge of examining and handling evaluation of the students, such as attainment levels against goals), and the Educational Improvement Committee (in charge of planning and handling curricula based on self-assessment and questionnaires) are set up within the committee for this program (see the attached sheet 54). Under the leadership and responsibility of the head of the program, all the teachers of this program work together in cooperation with each other to carry out the system.
(2) Program Assessment

- Criteria for program assessment:

Evaluation outcome of attainment levels against goals
Requests from students and demands of society
Evaluation outcome of self-assessment by faculties

- Method of assessment (connection with class evaluation to be described)

In addition to attainment levels evaluation summary sheet completed by the Education and Student Evaluation Committee, questionnaires by students and graduates, and self-assessment evaluation by faculties, an external
evaluation will be conducted.

- Procedure on giving feedback to students

In the case of problems with class subjects, faculties deal with these problems after taking into account the learning conditions of each individual student. The tutors or the Educational Improvement Committee members handle matters comprehensively, which is reflected in the improvement of the program through discussions in the committee.

## Cluster 3 （Applied Chemistry，Biotechnology and Chemical Engineering）

© Required subject（period of registration specified）
O Compulsory elective subject（any of these subjects shall be registerec
$\triangle$ Free elective subject（any of these subjects shall be registered）

| Subject Type |  |  |  |  | $\begin{array}{\|c\|} \hline \text { Required } \\ \text { No. of } \\ \text { credits } \end{array}$ | Class subjects |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | ， |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | 1st grade |  |  |  | 2nd grade |  |  |  | 3rd grade |  |  |  | 4 th grade |  |  |  |
|  |  |  |  |  | Spring Fall |  |  |  | Spring |  | Fall |  | Spring |  | Fall |  | Spring |  | Fall |  |
|  |  |  |  |  | 1T |  |  |  | 2T | 3T | 4T | 1T | 2 T | 3T | 4T | 1T | 2 T | 3 T | 4 T | 1T | 2 T | 3T | 4T |
| Peace Science Courses |  |  |  |  |  | 2 |  | 2 | Compulsory elective |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Introduction to University Education |  |  |  | 2 | Introduction to University Education | 2 | Required | © |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Introductory Seminar for First－Year Students |  |  |  | 2 | Introductory Seminar for First－ Year Students | 2 | Required | © |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Advanced Seminar |  |  | 0 |  | 1 | Free elective |  |  | $\triangle$ | $\triangle$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Area Courses |  |  | 4 | Courses in Arts and Humanities／Social Sc | 2 | Compulsory elective | $\bigcirc$ |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 4 | Courses in Natural Sciences | 2 |  |  | $\bigcirc$ |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | Basic English Usage | 2 | Basic English Usage I | 1 | Required | （0） | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Basic English Usage II | 1 |  |  |  | （ ） | （ ） |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  | Communication |  | Communication IA | 1 | Required | （0） | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Communication IB | 1 |  | （ $)$ | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  | Communication IIA | 1 | Required |  |  | （ $)$ | （） |  |  |  |  |  |  |  |  |  |  |  |  |
| $\frac{7}{7}$ |  |  |  |  |  | Communication IIB | 1 |  |  |  | （0） | （） |  |  |  |  |  |  |  |  |  |  |  |  |
| In |  |  | Initial Foreign Languages （Select one language from German，French，Spanish， Russian，Chinese，Korean and Arabic） |  |  | 1 subjects from Basic language I | 1 | Compulsor y elective | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\underset{\sim}{\underset{T}{x}}$ |  |  |  |  |  | 1 subjects from Basic language II | 1 |  |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| $\stackrel{y y}{\stackrel{y}{y}}$ |  | Info Scie | mation nce Cou | and Data rses | 2 | Introduction to Information and Data Sciencies | 2 | Required |  | © |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  | Heal | th and | Sports Courses | 2 |  | 1or2 | Compulsor y elective | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Basic Subjects |  |  |  | 15 | Calculus I | 2 | Required | （ $)$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Calculus II | 2 |  |  |  | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Linear Algebra I | 2 |  |  | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Linear Algebra II | 2 |  |  |  |  | （0） |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | General Mechanics I | 2 |  |  | （） |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | General Mechanics II | 2 |  |  |  |  | （） |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Experimental Methods and Laboratory Work in Physics I | 1 |  |  |  |  |  | （ |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Experimental Methods and Laboratorv Work in Physics II | 1 |  |  |  |  |  |  | © |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Seminar in Basic Mathematics I | 1 |  |  | （ $)$ |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | 1 | Seminar in Basic Mathematics II | 1 | Compulsor y elective |  |  |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Experımental Methods and Laboratory Work in Biology I（Note 5） | 1 |  |  |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Experimental Methods and Laboratory Work in Biology II | 1 |  |  |  |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  | Basic Electromagnetism | 2 |  |  |  |  | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  |  |
|  | Free elective subjects |  |  |  |  | 2 | From all Subject Type |  | $\begin{gathered} \text { Free } \\ \text { elective } \end{gathered}$ | $\triangle$ | $\triangle$ | $\triangle$ | $\triangle$ | $\triangle$ | $\triangle$ | $\triangle$ | $\triangle$ |  |  |  |  |  |  |  |  |
|  | No．of credits required for graduation |  |  |  |  | 44 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Note 1：When students fail to acquire the credit during the term or semester marked with $\bigcirc, \bigcirc, \triangle$ in the boxes for the year in which the course is taken，they can take the course in subsequent terms or semesters．Depending on class subject，courses may be offered in semesters or terms different from those scheduled．Please be sure to check the time schedule for Liberal Arts Education subjects to be issued every school year．
Note 2：The credit obtained by mastery of＂English－speaking Countries Field Research＂or self－directed study of＂Online Seminar in English A•B＂ cannot be counted towards the credit necessary for graduation．The credit obtained by Overseas Language Training can be recognized as Communication I or II if application is made in advance．For more details，please refer to the article on English in Liberal Arts Education in
Note 3：We have a recognition of credit system for foreign language proficiency tests．For more details，please refer to the article on Foreign Language in Liberal Arts Education in the student handbook．
Note 4：Students must take both「Experimental Methods and Laboratory WorkI in Physics I（1credit）」and「Experimental Methods and Laboratory WorkII in Physics II（1credit）$\rfloor$ ．
Note 5：Experimental Methods and Laboratory Work in Biology I should basically be taken together with Experimental Methods and Laboratory Work in Biology II．Person who took Methods and Laboratory Work in Biology I can take Experimental Methods and Laboratory Work in Biology II．

## Cluster 3 Specialized Basic Subjects

©Required

| Class Subjects |  |  |  |  |  | Class Hours/ Week |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  |  | 1st grade |  |  |  | 2nd grade |  |  |  |  | 3rd grade |  |  |  |  | 4th grade |  |  |  |  |
|  |  |  |  |  |  | Spring |  | Fall |  | Spring |  | Fall |  |  | Spring |  | Fall |  |  | Spring |  | Fall |  |  |
|  |  |  |  |  |  | 1T | 2 T | 3 T | 4T | 1T | 2 T | 3 T |  | 4 T | 1T | 2 | 3 |  | T | 1T | 2 T | 3T | 4T |  |
| Applied Mathematics I | 2 | $\bigcirc$ | $\bigcirc$ | (0) | $\bigcirc$ |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Applied Mathematics II | 2 | $\bigcirc$ | $\bigcirc$ |  | © |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Applied Mathematics III | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |
| Basic Engineering Computer Programming | 2 | © | O |  | () |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Probability and Statistics | 2 |  |  |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |
| Technical English | 1 | © | O | © | () |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |
| Basic Environmental Sciences | 2 |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Chemical Stoichiometry | 2 | © | $\bigcirc$ |  | - |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basic Organic Chemistry I | 2 | $\bigcirc$ | $\bigcirc$ | © | O |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basic Organic Chemistry II | 2 |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Physical Chemistry I | 2 | $\bigcirc$ | $\bigcirc$ | © | - |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Biochemistry I | 2 | © | $\bigcirc$ | O | - |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basic Experiments in Chemistry | 4 | $\bigcirc$ | $\bigcirc$ | © | - |  |  |  |  |  |  | 12 |  | 12 |  |  |  |  |  |  |  |  |  |  |
| Basic Inorganic Chemistry | 2 | © | $\bigcirc$ | © | $\bigcirc$ |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Analytical Chemistry | 2 | $\bigcirc$ | $\bigcirc$ | © | () |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Basic life science | 2 |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| 为 | 2 |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Introduction to Fundamental Industry | 2 |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Cluster 3 Specialized Subjects (Program of Biotechnology)

©Required subjects
OCompulsory Elective subjects

| Class Subjects |  |  | Class Hours/ Week |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | Note |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  | 1st grade |  |  |  | 2nd grade |  |  |  | 3rd grade |  |  |  | 4th grade |  |  |  |  |
|  |  |  | Spring |  | Fall |  | Spring |  | Fall |  | Spring |  | Fall |  | Spring |  | Fall |  |  |
|  |  |  | 1T | 2T | 3T | 4 T | 1T | 2 T | 3T | 4T | 1T | 2 T | 3T | 4T | 1T | 2 T | 3T | 4T |  |
| Training of Biotechnology I | 4 | () |  |  |  |  |  |  |  |  | 12 | 12 |  |  |  |  |  |  |  |
| Experiments on Biotechnology II | 4 | © |  |  |  |  |  |  |  |  |  |  | 12 | 12 |  |  |  |  |  |
| MicrobiologyI | 2 | () |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |
| MicrobiologyII | 2 | © |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |
| Molecular biology I | 2 | © |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |
| Molecular biology II | 2 | () |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |
| Biochemistry II | 2 | () |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |
| BiochemistryIII | 2 | O |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |
| Enzyme Chemistry | 2 | $\bigcirc$ |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |
| Bioorganic Chemistry | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |
| Fermentation Technology | 2 | © |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |
| Biochemical Engineering | 2 | () |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |
| Glycotechnology \& Immunotechnology | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |
| Molecular BiologyIII | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |
| Genetic and protein engineering | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |
| Molecular Bioinformatics | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |
| Biotechnology | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |
| Croup Disessioso C Current E Biocechmoges Topics | 2 | () |  |  |  |  |  |  |  |  |  |  | 2 | 2 |  |  |  |  |  |
| FoodProcess Engineering I | 1 |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |  |  |  |
| Food Process Engineering II | 1 |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |  |
| FermentationProcess Engineering I | 1 |  |  |  |  |  |  |  |  |  |  |  |  |  | 1 | 1 |  |  |  |
| Fermentation process engineeringII | 2 |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |
| Fermentation Process Engineering III | 1 |  |  |  |  |  |  |  |  |  |  |  |  | 2 |  |  |  |  |  |
| Physical Chemistry II | 2 |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |  |
| Chemical Kinetics | 2 | $\bigcirc$ |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |
| Organic Structural Analysis | 2 |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |  |  |  |
| Advanced Organic Chemistry IV | 2 |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |
| Chemical Engineering Exercise I | 2 | $\bigcirc$ |  |  |  |  |  |  | 4 | 4 |  |  |  |  |  |  |  |  |  |
| Chemical Enginering Fundamentals | 2 | $\bigcirc$ |  |  |  |  |  |  | 2 | 2 |  |  |  |  |  |  |  |  |  |
| Green Technology | 2 |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |  |
| Recycling engineering | 2 |  |  |  |  |  |  |  |  |  |  |  |  | 4 |  |  |  |  |  |
| Graduation Thesis | 5 | © |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

## Sheet 2

## Academic Achievements in Biotechnology Program <br> The Relationship between Evaluation Items and Evaluation Criteria

| Academic Achievements |  |  | Evaluation Criteria |  |  |
| :---: | :---: | :---: | :---: | :---: | :---: |
| Evaluation Items |  |  | Excellent | Very Good | Good |
|  | (1) | Understanding of relations among human, society, nature, and engineering. (Target A) | Being able to fully understand diversity of sense of values and ways of thinking in areas other than engineering and able to take various consideration. | Being able to understand the relations and differences between engineering and other areas and being to take consideration to the standard level. | Being able to well understand the relations and differences between engineering areas and other areas and take various consideration to the standard level. |
|  | (2) | Understanding of basic natural science (target B) | Being able to fully understand mathematics and physics which are a base of engineering. | Being able to understand mathematics and physics in the standard level. | Being able to understand mathematics and physics well. |
|  | (3) | Acquisition of basic and advanced knowledge relating to biotechnology and life science. (Target/Lecture class) | Being able to understand chemistry, applied mathematics, process engineering, basic biological science, and applied biological science, which are essential to biotechnologists. | Being able to understand chemistry, applied mathematics, process engineering, basic biological science and applied biological science to the standard level. | Being able to understand basic and advanced discipline described on the left well. |
|  | (1) | Acquisition of basic and advanced skills relating to biotechnology and life science. (Target/ Research class) | Being able to display abilities required for biotechnological engineers: logical thinning ability, ability to conduct experiment along with a plan, ability to analyze data and explanation. | Being able to demonstrate standard level abilities to think logically, to plan and carry out research and to analyze data. | Being able to well demonstrate the ability described on the left. |
|  | (1) | Cultivation of ability creating concept and solving problesms (achievement target D) | Being able to display abilities, required for biotechnologists, such as to make plan and carry out research, to demonstrate research outcome, to discuss, and to solve problems. | To be able to demonstrate standard level abilities to make plan and carry out research, to show outcomes and to solve problems. | Being able to demonstrate the ability described on the left. |
| $\begin{gathered} \text { ت/ } \\ \stackrel{y}{0} \\ 0 \end{gathered}$ | (2) | Cultivation of communication skills (achievement target E) | Being able to show logical writing abilities, information transmission abilities to domestic and overseas, debating and information utilization. | To be able to demonstrate standard level abilities to make plan and carry out research, to show outcomes and to solve problems. | Being able to demonstrate the ability described on the left. |

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 of biotechnology.

Sheet3
Relationships between the evaluation items and class subjects

| Subject type | Class subjects | credits | $\begin{gathered} \text { Type of } \\ \text { cof } \\ \text { course } \\ \text { registr } \\ \text { ation } \\ \text { 区分 } \end{gathered}$ | Period | Evaluation items |  |  |  |  |  |  |  |  |  |  |  | Total weighted values of evaluatio $n$ items in the subject |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Knowledge and Understanding |  |  |  |  |  | $\begin{array}{\|c\|} \hline \text { Abilities and Skills } \\ \hline(1) \\ \hline \end{array}$ |  | Comprehensive Abilities |  |  |  |  |
|  |  |  |  |  | (1) |  | (2) |  | (3) |  |  |  | (1) |  | ( (2) |  |  |
|  |  |  |  |  | $\begin{array}{l}\text { Weighted } \\ \text { values of } \\ \text { evaluation } \\ \text { items in } \\ \text { ithe subject }\end{array}$ | $\begin{array}{\|l\|} \begin{array}{l} \text { Weightsed } \\ \text { values of } \\ \text { evaluation } \\ \text { items } \end{array} \\ \hline \end{array}$ |  |  | Weighted values of evaluation items in the subject | $\left\lvert\, \begin{aligned} & \text { Weightsed } \\ & \text { velueseof } \\ & \text { evaluation } \\ & \text { items } \end{aligned}\right.$ | Weighted values of evaluation items in the subject | Weightsed values of evaluation items | $\begin{aligned} & \begin{array}{l} \text { Weighted } \\ \text { values of } \\ \text { evaluation } \\ \text { iems in } \\ \text { the subject } \end{array} \\ & \hline \end{aligned}$ | Weightsed <br> values of <br> evaluation <br> items  | Weighted values of evaluation items in the subject | Weightsed <br> values of <br> evaluation <br> items |  |
| Liberal Atst Edeation |  | 2 | Required | 1 Isemsester | 40 | 1 |  |  |  |  |  |  | 40 | 1 | 20 | 1 | 100 |
| Liberal Atst Edeation | ${ }^{\text {Introuctuction to University Eduation }}$ | 2 | Required | 1 Lemsees | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Edeatation | Peace Science Courses | 2 | Elective | meseter | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Edacation | Area Courses | 8 | Elective | ster | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal Atrs Eduation | Basic English Usage I | 1 | Required | 120 |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atrs Eduation | Basic English Usage II | 1 | Required | 1 Iemeseter |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atst Edecation | CommunicationI A | 1 | Required | 1semseter |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atst Edeation | Communication IB | 1 | Required | sester |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atrs Education | Communication IIA | 1 | Required | 2 ememestar |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atst Education | Communication IIB | 1 | Required | 2 2emsester |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atst Edeation | Basic language I | 1 | Required | 1semsester | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Edacation | Basic language II | 1 | Required | 1 | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal Atrs Education | ormation and Datas Stienece Curres | 2 | Required | 1semseter |  |  |  |  |  |  |  |  |  |  | 100 | 1 | 100 |
| Liberal Atrs Education | Sormation and Datas Steience Coures | 2 | Required | 1 semsester | 100 | 1 |  |  |  |  |  |  |  |  |  |  | 100 |
| Liberal A Ars Edacation | CalculusI | 2 | Required | Isemses |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Education | CalculusII | 2 | Required | meses |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atrs Education | Linear AlgebraI | 2 | Required | ${ }^{\text {Isemseserer }}$ |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atss Education | Linear AlgebraII | 2 | Required | sester |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atrs Education | General Mechanics I | 2 | Required | 1 semsester |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Arst Education | General Mechanics II | 2 | Required | 2 2emesester |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Edecation | Smomamman | 2 | Required | 3 3emesester |  |  | 50 | 1 |  |  | 30 | 1 | 20 | 1 |  |  | 100 |
| Liberal Atst Edacation | Seminar in Basic Mathematics 1 | 1 | Elective | 1 1semsester |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atst Education | Seminar in Basic Mathematics II | 1 | Elective | 2 |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Liberal Atrs Education |  | 2 | Elective | 2 memsest |  |  |  |  |  |  | 80 | 1 | 20 | 1 |  |  | 100 |
| Liberal Atst Edacation | Basic Electromagnetism | 2 | Elective | mesester |  |  | 100 | 1 |  |  |  |  |  |  |  |  | 100 |
| Specialized Education | Applied Mathematics I | 2 | Required | 2 2emseste |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Applied Mathematics II | 2 | Required | 3 3emesester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Applied Mathematics III | 2 | Elective | 5 |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Probability and Statistics | 2 | Elective | Ssemsest |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Technical English | 1 | Required | msest |  |  |  |  | 20 | 1 |  |  |  |  | 80 | 1 | 100 |
| Specialized Education |  | 2 | Required | 3 |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Speciailized Education | Basic Environmental Sciences | 2 | Elective | 2 | 60 | 1 |  |  | 40 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Chemical Stoichiometry | 2 | Required | 3emsest |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Basic Organic Chemistry I | 2 | Required | 2emeseter |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Basic Organic Chemistry II | 2 | Elective | 2 2emester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Physical Chemistry I | 2 | Required | 3eemester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Biochemistry I | 2 | Required | 3emeseter |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Speciaized Education | Basic Experiments in Chemistry | 4 | Required | tsemsest |  |  |  |  |  |  | 80 | 1 | 20 | 1 |  |  | 100 |
| Specialized Education | Basic Inorganic Chemistry | 2 | Required | 2 |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Analytical Chemistry | 2 | Required | 3emester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Basic life science | 2 | Elective | 2emeseter | 40 | 1 |  |  | 60 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education |  | 2 | Elective | 3emsester | 40 | 1 |  |  | 60 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Introduction to Fimdamental Industry | 2 | Elective | 3 3emsester | 40 | 1 |  |  | 60 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Training of Biotechnology I | 4 | Required | Ssemeseter |  |  |  |  |  |  | 60 | 1 | 20 | 1 | 20 | 1 | 100 |
| Specialized Education | Experiments on Biotechnology II | 4 | Required | 6 |  |  |  |  |  |  | 60 | 1 | 20 | 1 | 20 | 1 | 100 |
| Specialized Education | MicrobiologyI | 2 | Required | temsest |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | MicrobiologyII | 2 | Required | Ssemeseter |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Molecular biology I | 2 | Required | 4emeseter |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Molecular biology II | 2 | Required | Ssemsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Biochemistry II | 2 | Required | tsem |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | BiochemistryIII | 2 | Required | 5 |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Enzyme Chemistry | 2 | Elective | tsemsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Bioorganic Chemistry | 2 | Elective | Semestes |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Fermentation Technology | 2 | Required | Ssemsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Biochemical Engineering | 2 | Required | Ssemsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |


| Subject type | Class subjects | credits | $\left\lvert\, \begin{gathered} \text { Type of } \\ \text { course } \\ \text { registr } \\ \text { ation } \\ \text { 区分 } \end{gathered}\right.$ | Period | Evaluation items |  |  |  |  |  |  |  |  |  |  |  | Total weighted values of evaluatio $n$ items in the subject |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  |  |  |  | Knowledge and Understanding |  |  |  |  |  | Abilities and Skills <br> $(1)$ |  | Comprehensive Abilities |  |  |  |  |
|  |  |  |  |  | (1) |  | (2) |  | (3) |  |  |  | (1) |  | (2) |  |  |
|  |  |  |  |  | Weighted values of evaluation items in the subject |  | Weighted values of evaluation items in the subject | Weightsed values of evaluation items | Weighted values of evaluation items in the subject | Weightsed values of evaluation items | Weighted values of evaluation items in the subject | Weightsed values of evaluation items | Weighted values of evaluation items in the subject | Weightsed values of evaluation items | Weighted values of evaluation items in the subject | Weightsed values of evaluation items |  |
| Specialized Education | Glycotechnology \& Immunotechnology | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Molecular BiologyIII | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Genetic and protein engineering | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Molecular Bioinformatics | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Biotechnology | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education |  | 2 | Required | 6semsester | 40 | 1 |  |  |  |  |  |  | 40 | 1 | 20 | 1 | 100 |
| Specialized Education | FoodProcess Engineering I | 1 | Elective | 5semsester | 20 | 1 |  |  | 80 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Food Process Engineering II | 1 | Elective | 6semsester | 20 | 1 |  |  | 80 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | FermentationProcess Engineering I | 1 | Elective | 7 Femsester | 20 | 1 |  |  | 80 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Fermentation process engineeringII | 2 | Elective | 5semsester | 20 | 1 |  |  | 80 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Fermentation Process Engineering III | 1 | Elective | 6semsester | 20 | 1 |  |  | 80 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Physical Chemistry II | 2 | Elective | 4semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Chemical Kinetics | 2 | Elective | 5semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Organic Structural Analysis | 2 | Elective | 4semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Advanced Organic Chemistry IV | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Chemical Engineering Exercise I | 2 | Elective | 4semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Chemical Engineering Fundamentals | 2 | Elective | 4semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Green Technology | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Recycling engineering | 2 | Elective | 6semsester |  |  |  |  | 100 | 1 |  |  |  |  |  |  | 100 |
| Specialized Education | Graduation Thesis | 5 | Required | 7,8semester | 10 | 1 |  |  |  |  | 50 | 1 | 20 | 1 | 20 | 1 | 100 |

Curriculum Map of Biotechnology

| Academic Achievement Evaliation Items |  | 1st grade |  | 2nd grade |  | 3rd grade |  | 4th grade |  |
| :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: | :---: |
|  |  | Spring | Fall | Spring | Fall | Spring | Fall | Spring | Fall |
|  | Understanding of relations among human, society, nature, and engineering. (Target A) |  |  |  |  | FFoodProcess Engineering I ( $\Delta$ ) | Frood Process Engineering II( $\Delta$ ) | Graduation Thesis(0) | Graduation Thesis(0) |
|  |  | sity Eduation (0) | Peace Science Courses( O ) |  |  | Frermentation proessensinieeringli $(\Delta)$ | Frementation Proeses Engineering III $($ ) | FrementationProcess Engineering I(L) |  |
|  |  | Area Courses (O) | Area Courses (O) |  |  |  |  |  |  |
|  |  | Health and Sports Courses( O ) | Health and Sports Courses (0) |  |  |  |  |  |  |
|  |  | Area Courses (O) | Area Courses(O) | Area Courses (O) | Area Courses (O) |  |  |  |  |
|  |  | Basic language I(O) | Basic Environmental Sciences( $\Delta$ ) | $\cdots$ |  |  |  |  |  |
|  |  | Basic language II(O) | Basic life science( $\Delta$ ) | Introduction to Fumamental 1 ndustry (L) |  |  |  |  |  |
|  | Understanding of basic natural science (target B) | CalculusI(O) | CalculusII(@) | 4tumutite |  |  |  |  |  |
|  |  | Linear AlgebraI (0) | Linear AlgebraII(0) |  |  |  |  |  |  |
|  |  | (2T)General Mechanics I(O) | (3))General Mechanics II(®) |  |  |  |  |  |  |
|  |  | Seminar in Basic Mathematics I(O) | Sseminar in Basic Mathematics II (0) |  |  |  |  |  |  |
|  |  |  | (47)Basic Electromagnetism (0) |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  | Acquisition of basic and advanced knowledge relating to biotechnology and life science. (Target/Lecture class) |  |  |  | Technical English(0) | Probability and Statistics ( $\Delta$ ) | Clisotecernolog \& Immunoteechology(0) |  |  |
|  |  |  | Basic Organic Chemistry II( $\Delta$ ) | Praic Rengieerins compter Prosamming(o) | Physical Chemistry II ( $\triangle$ ) | Applied Mathematics III ( $\Delta$ ) | Molecular BiologyIII(O) |  |  |
|  |  |  | Applied Mathematics I (0) | Applied Mathematics II (®) | MicrobiologyI (O) | MicrobiologyII (O) | Genetic and protein engineering(0) |  |  |
|  |  |  | Basic life science( $\triangle$ ) | Physical Chemistry I(®) | Molecular biology I (0) | Molecular biology II (0) | Molecular Bioinformatics (O) |  |  |
|  |  |  | Basic Environmental Scieneses $(\Delta)$ | Chemical Stoichiometry(0) | Biochemistry II (0) | BiochemistryIII(O) | Biotechnology (O) |  |  |
|  |  |  | Basic Organic Chemistry I(O) | Biochemistry I(0) | Enzyme Chemistry (0) | Bioorganic Chemistry(0) | Advaneed Organic Chemisty IV ( $\Delta$ ) |  |  |
|  |  |  | Basic Inorganic Chemistry(©) | Analytical Chemistry (0) | Chemieal Fnininering Findamenals (0) | Fermentation Technology (0) | Green Technology ( $\triangle$ ) |  |  |
|  |  |  |  | $\pm$ | Chemical Engineering Exerise ( 0 ) | Biochemical Engineering(0) | Recycling engineering ( $\triangle$ ) |  |  |
|  |  |  |  | Imtroduction to Findamenal Industry $(\Delta)$ | Organic Structural Analysis ( $\Delta$ ) | Chemical Kinetics (O) | Food Process Engineering II $(\Delta)$ |  |  |
|  |  |  |  |  |  | FoodProcess Engineering I ( $\Delta$ ) | Frementation Proese Engineering III $($ ) |  |  |
|  |  |  |  |  |  | FPermentation proess engineeringli ( $\Delta$ ) |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  | Acquisition of basic and advanced skills relating to biotechnology and life science. (Target/ Research class) |  | - |  | Basic Experiments in Chemistry(0) | Training of Biotechnology (@) | Experiments on Biotechnology II()) | Graduation Thesis(0) | Graduation Thesis(0) |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| Cultivation of ability creating concept and solving problesms (achievement target D) |  |  | - |  | Pasic Experiments in Chemistry(0) | Training of Biotechnology I(O) | Experiments on Biotechnology II()) | Graduation Thesis(0) | Graduation Thesis(0) |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |
| $\left.\left\lvert\, \begin{array}{c} 0 \\ 0 \end{array}\right.\right)$ | Cultivation of communication skills (achievement target E) |  |  |  | Technical English(0) | Training of Biotechnology I(®) | Experiments on Biotechnology II (0) | Graduation Thesis(0) | Graduation Thesis(0) |
| $\underset{\sim}{0}$ |  | Communication IA (O) | Communication IIA (0) |  |  |  | dill |  |  |
| $\mid$ |  | Communication IB (O) | Communication IIB(O) |  |  |  |  |  |  |
| घ |  | Basic English Usagel(O) |  |  |  |  |  |  |  |
|  |  | Basic English UsageII (○) |  |  |  |  |  |  |  |
|  |  | arphermation and Datas sieme Coureses (e) |  |  |  |  |  |  |  |
|  |  | (Ex) | Liberal Arts Education Subjects | Basic Specialized Subjects | Specialized Subjects | Graduation Thesis | (O)Required (O) Compulsory elective ( $\triangle$ ) Free elective |  |  |

