Name of School (Program)〔School of Engineering Cluster 3 (Applied Chemistry, Biotechnology and Chemical Engineering)〕

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Program name (Japanese)	化学工学プログラム
(English)	Program of Chemical Engineering

1. Academic degree to be acquired

Bachelor's degree in engineering

2. Overview

Chemical engineering is the academic system of engineering that is needed in order to make chemistry useful in real life. In other words, it is "the engineering of chemistry". For instance, in order for us to make use of newly-discovered or synthesized substances, which have highly useful functions, in real life, it is first necessary to efficiently produce the needed quantity of industrial products based on these substances at a reasonable price. Therefore, we must make effective use of limited resources and energy, and select or develop the most efficient production system that gives consideration to the environment. Essentially, we must first study which raw materials we can use to produce the intended product, by what reactions, processes, equipment, and operational conditions it can be produced, and how we can detoxify the waste products and return them to nature. Only after we have done these we can finally decide on the production system. Chemical engineering is the academic system that brings together the development of the optimal production system, the design of new plants and equipment, and the fundamentals necessary for operational management.

Chemical engineering has developed as an academic field necessary for the development of production process for chemical products. The production processes for other products, for instance those for food items, medical products, iron and steel, and those related to the energy industry, can be carried out in the same way as those used for chemical products and, therefore, engineers who have studied chemical engineering perform well in various industries. It is also possible to develop new functional materials by devising production processes based on the academic system of chemical engineering, and today's chemical engineering has been drawing attention to this. Furthermore, since the development of optimal production systems and new plants is conducted in harmony with nature, chemical engineering is also helpful in creating a sustainable society.

This program aims at developing professionals who have acquired the fundamentals of, and expertise in, chemical engineering through education and research into the efficient use of substances, energy, and reaction processes. The philosophy of chemical engineering has become an indispensable tool for solving environmental issues in which it is necessary to consider resources, energy, safety, economy, and society in an integrated manner, 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

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 con

(B) Cultivation of logical thinking ability.

Transfer", "Fluids Engineering", "Mass Transfer", "Chemical Reaction Engineering", "Powder Technology", "Process Control Engineering", "Chemical Equipment Design and Practice", "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, reliability, and social impact, by completing "Chemical Process Design", " Chemical Industry Process", and "Chemical Process and Engineering Ethics".

(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 "Introduction to University Education", "Introductory Seminar for First-Year Students", "Chemical Process Design", and "Graduation Thesis".

(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 completing "Introductory Seminar for First-Year Students", "Elements of Information Literacy or Exercise in Information Literacy", "Communication Course", "Initial Foreign Languages", "Technical English", "Chemical Process Design", and "Graduation Thesis".

5. Program Timing and Acceptance Conditions

○ When to start the program:

The second semester of the second year

Cluster 3 offers distinctive education that has organically integrated the fields of chemistry, biotechnology, and chemical engineering. Specifically, it aims at developing professionals that possess technical expertise in harmony with 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 processes; environmental preservation and purification; and the development of resources and energy. To achieve this aim, in addition to the common, wide-ranging specialized basic education, three programs have been prepared that provide specialized education in chemistry, biotechnology, and chemical engineering. These are the Program of Applied Chemistry, the Program of Biotechnology, and the Program of Chemical Engineering.

Registration on these three programs is to be made in the second semester of the second year, so that students can choose a suitable specialized field or program while acquiring a wide range of specialized basic knowledge.

○ Credit Requirements

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 Experiments in Chemistry" and "Technical English") and must acquire a total of 60 or more credits overall (including in Liberal Arts Education).

○ 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 requests from students and their academic results.

6. Obtainable Qualifications

・Type-1 High School Teaching License (Industry) (By completing “Vocational Guidance”, the prescribed “Liberal Arts Education Subjects” and “Specialized Education Subjects”, students can obtain a Type-1 High School Teaching License (Industry) upon graduation.)

・Superintendent boiler operator (Graduates from the school of engineering, who have completed the boiler-related courses while in school and have undergone hands-on training about handling boilers for more than one or two years after graduation, are eligible to take the license examination for first-class boiler operator or the license examination for special-class boiler operator.)

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as well as the ability to conduct research voluntarily

(3) The ability to understand the social requirements of research contents, their impact on society or on nature, and the significance of this impact, as well as the ability to recognize the contribution made by researchers, and their responsibilities, from a multifaceted perspective

(4) The ability to understand the principles, structure, and operational procedures of equipment, and the ability to use it properly, as well as the ability to observe the phenomena resulting from experimental operations, and to write down the necessary information in laboratory notebooks

and logical thinking skills.

・The interim graduation thesis presentation (December) and the final presentation (February) will be held, and students will receive training in presentation of results, summary writing, and question and answer sessions, and all the staff check and evaluate educational effects of the graduation thesis.

・Guidance is given about how to compose reports and how to think logically through the writing of the graduation thesis.

10. Responsibility System

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

To work on the evaluation of the program, this program organizes three committees (the Educational Evaluation Committee, the Student Evaluation Committee, and the Educational Improvement Committee), the Managing Committee, which oversees these three committees, and the Program Evaluation Committee, which is an external evaluation committee consisting mainly of business people. The following are the major roles of each committee.

The Educational Evaluation Committee conducts questionnaires to evaluate attainment levels against the goals (class improvement questionnaires directed at students and staff), questionnaires to evaluate the validity of the goals (questionnaires at the time of students’ graduation, and questionnaires targeting graduates and their superiors). The committee checks, evaluates, and improves the educational systems such as curricula, educational environments, and support systems. Based on the results of the questionnaires, the committee checks and evaluates the validity of the current educational system.

The Student Evaluation Committee mainly evaluates and improves the system that assesses the students’ educational status. The committee evaluates the attainment levels of each subject against the students’ goals by the use of the class improvement questionnaires and grade summary sheets, and, for the purpose of increasing consciousness of learning and educational effects, it surveys the students’ learning situation and makes recommendations for improvement as necessary.

The Educational Improvement Committee reviews the curricula in terms of achievement of the goals, based on the recommendations for improvement and the results of the various of questionnaires submitted by the Student Evaluation Committee and the Educational Evaluation Committee, and devises new goals as needed. Furthermore, the committee makes recommendations about improvement of the educational environments and support systems. The task of each committee overlaps partially, and this system enables the committees to check each other while working in collaboration with each other. All of the staff in charge of the program belong to one of the committees. The Managing Committee, which oversees the Educational Evaluation Committee, the Student Evaluation Committee, and the Educational Improvement Committee, has the program supervisor as its chairperson. To move ahead with the educational program (DO), the committee checks and evaluates the students’ goal attainment levels and the educational systems (educational tools, educational environments, etc.) (CHECK), suggests educational improvements (ACT) and sets the goals to be achieved, including the level or achievement necessary to meet these goals (PLAN). In this way, the Managing Committee gives guidance to each other committee for the smooth running of the PDCA system. As such, this program has in place a system under which all the staff in charge cooperate and move ahead together, with the program supervisor taking overall responsibility.

(2) Program assessment

○ Criteria for 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)
- Teachers' comments on students' class improvement questionnaires 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 of students' graduation (targeted at fourth year students, implemented 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)
- Preparing the survey on attainment levels of students' academic results in order to understand the academic 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)

○ How to assess the program

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 committees then submit recommendations for improvement with reference to the students' requests, and improvement reports by the teacher in charge of each subject. The Managing Committee that

To improve student education, this program has introduced a new system for tutors and various questionnaires. In other words, by use of the attainment table, the tutors in each grade understand not only individual student's academic results and attainment level, but also the entire grade's academic results and attainment levels, and are in a position to identify improvements. Based on this, by conducting interviews with

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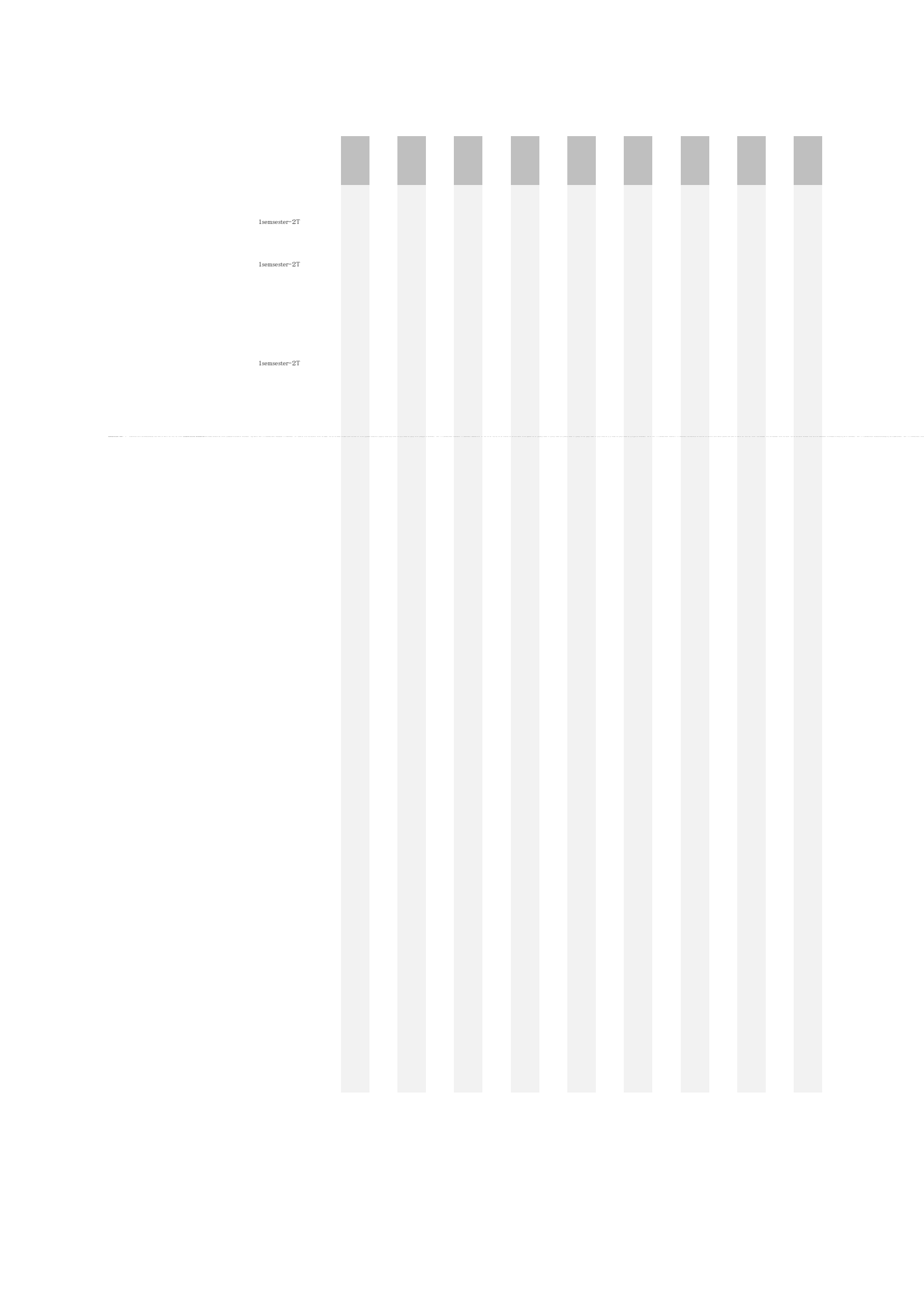
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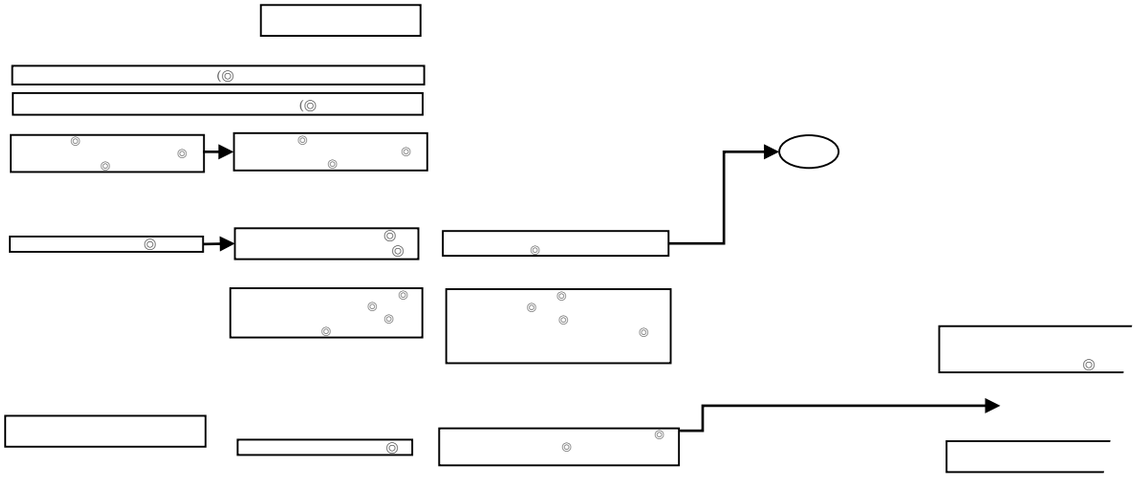

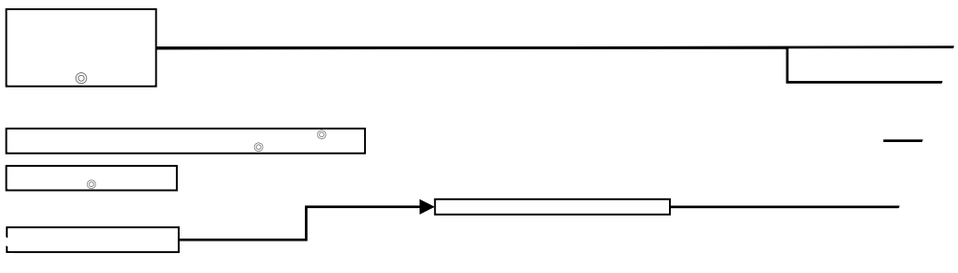

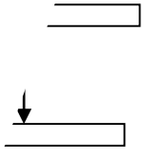

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