Criteria for Accrediting
Japanese Engineering Education Programs
Leading to Bachelor's Degree

Applicable in the year 2008

Approved by the JABEE Board of Directors
On November 25, 2003

Program Criteria by Field for Civil Engineering and
Program Criteria by Field for Mechanical Engineering
have been revised since 2008.

The original text of "Criteria for Accrediting Japanese Engineering Education Programs" is written in Japanese. This is English translation of the original text.

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Contents

Criteria for Accrediting Japanese Engineering Education Programs Leading to Bachelor's Degree

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These criteria are hereby stipulated for the accreditation of the basic educational programs to develop engineers provided by institutions of higher education. A program seeking accreditation must provide explanations together with supporting materials demonstrating that the program meets all of the following six criteria (including those contained in the "Supplement" if applicable).

"Engineers" here refers to engineering professionals as widely defined, including those engaged in research and development works.

Criterion 1: Establishment and Disclosure of Learning and Educational Objectives

(1) For the purpose of fostering self-reliant engineers, the program must establish specific learning and educational objectives that concretize the contents of knowledge and abilities described in items (a) - (h) below. The learning and educational objectives must be disclosed widely on and off campus and must be known to the faculty members and students involved in the program.

(a) An ability and intellectual foundation to consider issues from a global and multilateral viewpoint.
(b) Understanding of the effects and impact of engineering on society and nature, and of engineers' social responsibility (engineering ethics).
(c) Knowledge of mathematics, natural sciences and information technology and an ability to apply such knowledge.
(d) Specialized engineering knowledge in each applicable field, and an ability to apply such knowledge to provide solutions to actual problems.
(e) Design abilities to organize comprehensive solutions to societal needs by exploiting various disciplines of science, engineering and information.
(f) Japanese-language communication skills including methodical writing, verbal presentation and debate abilities, as well as basic skills for international communication.
(g) An ability to carry on learning on an independent and sustainable basis.

(h) An ability to implement and organize works systematically under given constraints.

(2) The learning and educational objectives must be established, giving due consideration to each institution's traditions and resources, to the specific fields in which its graduates are particularly active, and to social needs and students' requirements.

Criterion 2: Quantitative Curriculum Requirements

(1) The program must comprise the equivalent of four years of undergraduate study / education, and must qualify as graduates those students who have achieved a bachelor's degree after earning 124 or more credit units.

(2) The curriculum must comprise a total of at least 1,800 contact hours (class hours as well as study hours under faculty guidance). Moreover, this must include at least 250 hours of study in the humanities and social sciences, etc. (including language studies), at least 250 hours of study in mathematics, natural sciences and information technology, and at least 900 hours of study in the field of specialization.

Criterion 3: Educational Methods

3.1 Admission and Enrollment

(1) The program must establish specific procedures to attract students with adequate qualifications and resources as required to achieve the learning and educational objectives. These procedures must be displayed on and off campus. The selection process of the students must be in accordance with these procedures.

(2) In the case where students are enrolled in the program after completing general education courses, etc., the program must establish specific procedures for selecting students for admission to the program, taking into consideration the fact that the students' performance in learning including general education courses from the time of their admission to the institution should be examined. The procedures must be displayed to the faculty members and students involved in the program. The selection of such students must be in accordance with these procedures.

(3) The program must establish specific procedures for admission of transfer students in the case where transfer students are accepted. The procedures must be displayed on

and off campus. The admission of such transfer students must be in accordance with these procedures.

3.2 Educational Methods

(1) The program's curriculum must be designed to ensure that students achieve the program's learning and educational objectives. Moreover, the curriculum must be displayed to the faculty members and students involved in the program. The corresponding relationship between each subject and the program's learning and educational objectives must clearly be shown in the curriculum.

(2) A syllabus must be prepared for each subject based on the curriculum design and must be displayed to the faculty members and students involved in the program. Educational activities must be implemented in accordance with the syllabus. The syllabus for each subject must clearly indicate how each subject is positioned within the curriculum, and must also indicate the educational content and methods, the goals to be achieved, as well as the methods and criteria for evaluating students' performance.

(3) The program must establish a system that enhances students' understanding of class work and other program content, promoting students' enthusiasm to learn, while coping with students' requests. The structures of this system must be displayed to the faculty members and students involved in the program, and the necessary activities must be implemented.

(4) The students must be allowed to regularly assess their own level of achievement against the program's learning and educational objectives, for motivation and orientation in their own study.

3.3 Educational Organization

(1) The program must provide sufficient numbers of talented faculty, coupled with an educational support system, to deploy the curriculum designed to achieve the learning and educational objectives of the program, by means of appropriate educational methods to attain actual educational results.

(2) The program must establish a faculty development system designed to improve the

quality of the faculty, and display it to the faculty members involved in the program. The necessary activities must be implemented.

(3) The program must establish an evaluation method to determine the educational contributions of each faculty member and display it to the faculty members involved in the program. The evaluation of educational contributions must be implemented in accordance with the method.

(4) The program must establish an intra-faculty liaison network system to ensure closer coordination among the subjects within the curriculum, while enhancing and improving the effectiveness of the program. The program must implement activities relevant to such a system.

Criterion 4: Educational Environment

4.1 Facilities and Equipment

(1) The program must have sufficient classrooms, laboratories, practice rooms, libraries, information technology facilities, study rooms, rest areas, cafeterias, and other relevant facilities and equipment as required for achieving the program's learning and educational objectives.

4.2 Financial Resources

(1) The program must endeavor to secure adequate financial resources to provide, maintain and operate the facilities and equipment as needed to achieve the program's learning and educational objectives.

4.3 Student Support System

(1) Concerning the educational environment, the program must provide a system that promotes students' enthusiasm to learn while attending to students' requests, and display the system to the faculty members, office staff and students involved in the program. The necessary activities must be implemented.

Criterion 5: Evaluation of Students' Level of Achievement against the Learning and

Educational Objectives

(1) The program must evaluate students' level of achievement against the objectives for each subject in accordance with the evaluation methods and criteria described in the syllabi.

(2) The program must provide methods of evaluating credit units earned by the program students at other institutions of higher education, and such credit units must be converted according to such methods. Also the program must provide methods of evaluating credit units earned by transferred students at other institutions prior to their admission to the program, and such credit units must be converted according to such methods.

(3) The program must establish methods and criteria for comprehensively evaluating the level of students' achievement against each learning and educational objective of the program. The evaluations must be carried out according to such methods and criteria.

(4) All graduates of the program must have achieved all of the program's learning and educational objectives.

Criterion 6: Educational Improvement

6.1 Educational Feedback System

(1) The program must provide an educational feedback system that examines the program in accordance with Criteria 1 - 5 on the basis of the results of evaluation regarding the level of student achievement against the learning and educational objectives. Also the program must display the system to the faculty members involved in the program. The necessary activities must be implemented.

(2) The educational feedback system must be designed and actually operated to attend to societal needs and students' requests, as well as to check the functions of the system itself.

(3) The records of the activities such as meetings and committees, etc comprising the educational feedback system must be viewable by the faculty members involved in the program.

6.2 Continuous Improvement

(1) The program must provide a system that continuously improves the program in accordance with Criteria 1 – 6 on the basis of the educational feedback. The necessary activities must be implemented.

Supplement: Program Criteria by Field

Program Criteria by Field provide supplementary guidelines for applying the Accreditation Criteria to programs in a specific field. Program Criteria by Field shall primarily address matters regarding the learning and educational objectives [i.e. Criterion 1 (1) (d), etc.], and the faculty [i.e. Criterion 3.3 (1), etc.].

Program Criteria by Field for Agricultural Engineering

These Program Criteria by Field apply to engineering programs in Agricultural Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) A knowledge of common subjects such as applied mathematics, physics, chemistry or biology

(2) Knowledge and abilities for major subjects of the following division programs in the related fields to agricultural engineering.

(2-1) Program for Regional and Environmental Engineering

Major area of the Program of Regional and Environmental Engineering are “Soil”, “Water”, “Foundation” and “Environment”. Graduates are required for acquiring knowledge and abilities either in the three areas of “Soil”, “Water” and “Foundation” or “Soil”, “Water” and “Environment”.

(2-2) Program of Environmental Engineering for Agriculture

Major area of the Program of Environmental Engineering for Agriculture is Agricultural Meteorology and Biological Environment, Bioproduction System and Food System, Information for Agriculture and for Biological Environment, and Agricultural Machinery, Working System. Graduates are required for acquiring knowledge and abilities in a minimum of two of the four curriculum areas.

(3) Capabilities to make plan and perform experiments and explorations, and to analyze, consider and interpret data in more than one major field of each division program in the educational programs for agricultural engineering and similarly named engineering programs.

(4) After completing the fundamental subjects in the agricultural engineering, and the major subjects in each division program, students are required to acquire knowledge and abilities to investigate certain themes, to make plan of their research and to solve problems using professional knowledge and skills in the related fields in agricultural engineering.

(5) Students are required for getting basic engineering abilities and skills to understand practical problems and themes and to prepare for them appropriately and quickly.

2. Faculty

The following faculty members must be included; members qualified as professional engineers, or ones having abilities to teach practical engineering related to educational matters.

Refer to: The Japanese Society of Irrigation, Drainage and Reclamation Engineering

http://www.jsidre.or.jp/jabee

Program Criteria by Field for Agricultural Science and Engineering

These Program Criteria by Field apply to engineering programs in agricultural science and engineering including agri-based "forest", "plant", "animal", "biochemical", "economic", and "fishery" fields.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Fundamental knowledge and abilities;

The program must demonstrate the graduates have the ability to apply life science, biological production science, biological resource science, and environmental science; a knowledge in relevant field(s) such as applied chemistry, applied physics, and/or economics.

Programs must also demonstrate that graduates have; the ability to conduct laboratory works and/or field survey and to critically analyze and interpret data in one or more of agricultural engineering areas mentioned above; an ability to perform engineering design by means of design experiences integrated throughout the professional component of the curriculum; understanding of concepts of professional practice such as procurement, bidding versus quality-based selection processes, interaction of project design and construction professionals.

2. Faculty

The program shall demonstrate that those faculty teaching courses which are primarily design in content are qualified to teach the subject matter by virtue of education and experience or professional licensure.

Supplementary explanations

1) The faculty expertise for the professional area includes those of full-time and part-time positions, and those having an additional post.

2) The programs in the specified areas including agri-based "forest", "plant", "animal", "biochemical", "economic", and "fishery" will be reviewed by related academic societies.

3) The principle and specific design of the program in the specified areas including agri-based "forest", "plant", "animal", "biochemical", "economic", and "fishery", will be offered by related academic societies.

Refer to: The Foundation of Agricultural Science of Japan http://www.nougaku.jp

Program Criteria by Field for Architecture and Building Engineering

These Program Criteria by Field apply to engineering programs in Architecture and Building Engineering.

1. Knowledge and abilities to be acquired

A program in the field of Architecture and Building Engineering must develop and disclose definitive leaning and educational objectives. The leaning and educational objectives must consist of providing proficiency in the field as itemized in (1) below, and of providing an advanced knowledge in at least one of the specialized fields itemized in (2) below.

Although a program in Architecture and Building Engineering-related field must comply with the above requirements, individual programs may develop additional unique leaning and educational objectives.

(1) Proficiency in the field of Architecture and Building Engineering
Graduates must have proficiency in Architecture and Buildings Engineering including artistic, technical, cultural, social, legal and historical aspects as well as lifecycle issues; a comprehensive understanding in the various ranges of topics in Architecture and Building Engineering; and the basic ability to plan, design, construct and maintain buildings and human environments.

(2) Advanced knowledge and abilities in a specialized field related to Architecture and Building Engineering
Graduates must be proficient in one of the following advanced topics: Architectural planning; Architectural design and planning; Urban design and planning; Residences; Building environments; Building facilities; Structural engineering; Disaster prevention; Building materials; Construction management; Building operation and maintenance; Conservation and restoration. As an alternative, graduates must have advanced level of knowledge of the items described in (1), and an ability to apply such knowledge to practical business.

2. Faculty

An individual faculty member as well as the faculty as a group must possess the capacity to provide a comprehensive education consisting of the philosophy, knowledge, technology as well as practical business of Architecture and Building Engineering.

Refer to: Architectural Institute of Japan http://www.aij.or.jp/jpn/aijedu/aijedu.htm

Program Criteria by Field for Biochemical, Biological and Biophysical Engineering

These Program Criteria by Field apply to engineering programs in Biochemical, Biological and Biophysical Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Knowledge of applied mathematics and ability to apply bio-related information processing technique.

(2) The knowledge and ability to apply the knowledge to solve problems in two or more disciplines or an integrated discipline of major disciplines of this field, i.e. biology, biological chemistry, cell technology, bioinformatics, biochemical engineering, biomedical engineering and environmental bioengineering.

a) Knowledge and technique in a major discipline

b) Ability to plan and conduct experiment and/or investigation and to analyze the data obtained, as well as to explain the results of consideration.

c) Ability to research, organize, and solve problems utilizing knowledge and technique specialized.

d) Fundamental ability to understand and properly handle the subjects encountered by the engineers in this field.

2. Faculty

Program faculty must include those who are qualified to teach subject matters by virtue of professional certification or practical engineering experiences.

Refer to: The Society for Biotechnology, Japan http://www.nacos.com/sfbj/

Program Criteria by Field for Chemical and Chemistry-Related Engineering

These Program Criteria by Field apply to engineering programs in Chemical and Chemistry-Related Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) **Engineering Fundamentals**: Knowledge and ability to apply that knowledge to solve problems of fundamental engineering topics, including engineering (applied) mathematics and information technology.

(2) **Chemical Engineering Fundamentals**: Knowledge and ability to apply that knowledge to solve problems of mass and energy balances applied to chemical processes, engineering thermodynamics including phase and chemical equilibria, and heat, mass and momentum transfer.

(3) **Fundamental Program Components**: Knowledge, appropriate modern experimental techniques and ability to apply that knowledge and techniques to solve problems of at least four disciplines, selected as appropriate to the goals of the program, from organic chemistry, inorganic chemistry, physical chemistry, analytical chemistry, polymer chemistry, materials chemistry, electrochemistry, photochemistry, surface chemistry, pharmaceutical chemistry, biochemistry, environmental chemistry, energy chemistry, separation engineering, reaction engineering and process systems engineering.

(4) **Advanced Program Components:** Professional knowledge of at least one discipline among those listed in (3), and design/managing capabilities, by use of that knowledge, to solve problems in consideration of economy, safety, reliability, social and environmental aspects.

2. Faculty

Program faculty should include member(s) qualified to teach courses by virtue of professional licensure or through their consulting, design and management experience.

Supplementary Explanations

1. In chemical and chemistry-related engineering discipline, two courses are provided, **Chemical Engineering Course** and **Applied Chemistry Course**, as specified in Table 1.

2. When each program would like to undergo accreditation in chemical and chemistry-related engineering discipline, it is necessary to specify the course in reference to the guidelines in Table 1.

3. The educational contents of each program must be arranged in the layered structure of **(1) Engineering Fundamentals**, **(2) Chemical Engineering**

Fundamentals, **(3) Fundamental Program Components**, and **(4) Advanced Program Components** based on the basic knowledge of mathematics, natural science and information technology referred to **Criteria 1 (1) (c)**. The educational content that is "knowledge and abilities to be acquired" listed does not specify the curriculum course name, and each program can use an appropriate name. Furthermore, it is permissible for one curriculum course be assigned to more than one area in (1)-(4).

4. "Knowledge and abilities to be acquired" such as materials characterization, electrical engineering, material science and engineering, fluid mechanics, environmental engineering, safety engineering, engineering receptive, intellectual property, manufacturing economics are included in **(1) Engineering Fundamentals**, in addition to engineering (applied) mathematics and information technology. Again, these subjects do not specify the actual curriculum course names.

5. The "professional knowledge" in **(4) Advanced Program Component** includes professional knowledge obtained through graduation research work, seminars, and other learning opportunities in addition to lectures.

6. It is allowed to include abilities obtained through graduation research work, seminars, and other learning opportunities in the "ability to apply that knowledge to solve problems, to design processes and to manage projects, in consideration of economic, safety, reliability, social and environmental aspects" specified in **(4) Advanced Program Component**.

7. The design capability referred to in **(4) Advanced Program Component** means not only for the design of equipment and systems but also that for problem-solving means.

Table 1 Guidelines

Educational Content	Chemical Engineering Course	Applied Chemistry Course
(1) Engineering Fundamentals	120 hours	80 hours
(2) Chemical Engineering Fundamentals	60 hours	60 hours
(3) Fundamental Program Components	120 hours, including at least 60 hours of chemical engineering courses such as Separation Engineering, Reaction Engineering, Process Systems Engineering.	160 hours
(4) Advanced Program Components	80 hours	80 hours
Total	380 hours	380 hours

Refer to: JABEE Committee for Chemical and Chemistry-Related Engineering http://www.csj.jp/gaku/jabee/

Program Criteria by Field for Civil Engineering

Revised in 2008

These Program Criteria by Field apply to engineering programs in Civil Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Knowledge in applied mathematics.

(2) Knowledge in at least one natural science among physics, chemistry, biology and earth science.

(3) Knowledge in a minimum of three recognized major areas of (i)construction materials, basic mechanics and construction management, (ii)structural engineering, earthquake engineering and maintenance engineering, (iii)geotechnical engineering, (iv)hydraulics and hydraulic engineering, (v)traffic engineering and national planning, and (vi)environmental systems for civil engineering.

(4) Ability to plan and conduct laboratory experiments and to critically analyze and interpret data in more than one area among those listed in (3).

(5) Ability to practice self-learning and encourage creativity, and to solve problems throughout exercises in a minimum of one area of those listed in (3).

(6) Ability to seek issues, set up logic and solve problems by means of taking courses integrates throughout the professional component of the curriculum for civil engineering.

(7) Ability to understand the professional practical issues and to respond to them appropriately.

2. Faculty

The program faculty must include a faculty member qualified to teach the subject matter by virtue of professional licensure, or by education and design experiences.

Refer to: Japan Society of Civil Engineers http://www.jsce.or.jp/opcet/jabee/

Program Criteria by Field for Electrical, Electronics and Communications Engineering

These Program Criteria by Field apply to engineering programs in Electrical, Electronics, Communications Engineering, including Electrical & Electronic Engineering, Information & Telecommunication Engineering, Electronics, and Instrumental / Control / System Engineering, etc.

1. Knowledge and abilities to be acquired

(1) The structure of curriculum must provide both breadth and depth across the range of engineering topics implied by the program title.

(2) The program must demonstrate that the graduates have acquired the followings;

a) Knowledge of mathematics (including differential and integral calculus, differential equations, linear algebra, complex variables, and discrete mathematics), probability and statistics, basic sciences especially physics and engineering sciences necessary for the achievement of the learning/educational objectives.

b) Ability not only to plan experimental projects and perform practical experiments as appropriate to the program learning/educational objectives, but also to analyze and explain the experimental results.

c) Ability to analyze, assemble and settle devices, software, and systems as appropriate to the program learning/educational objectives, using specialized knowledge and skills.

d) Ability to understand practical problems and subjects from the standpoint of engineers of specified disciplines shown by the program title.

2. Faculty

The faculty must include members who are qualified for teaching practice business related to the learning/educational objectives of the program.

Supplementary Explanations:

1) The institute of Electronics, Information and Communication Engineers and the Institute of Electrical Engineers are responsible for jointly conducting the evaluation of program in this field.

2) Concrete discipline in the field of Electrical, Electronics, Communications Engineering (as Electrical & Electronic Engineering, Information & Telecommunication Engineering, Electronics, and Instrumental / Control / System Engineering, etc.) and contents / objectives of educational program should be established by applicant institutions.

Refer to: The Institute of Electrical Engineers of Japan http://www.iee.or.jp/eng_edu/
The Institute of Electronics, Information and Communication Engineers
http://www.ieice.org/jpn/jabee/sinsakijun.html

Program Criteria by Field for Engineering Physics and Applied Physics

These Program Criteria by Field apply to engineering programs in Engineering Physics and Applied Physics.

1. Knowledge and abilities to be acquired

Upon completion of the program, the graduates should have the following knowledge and abilities:

(1) Fundamental Ability

a) Basic knowledge and skills of mathematics (calculus, linear algebra, vector analysis, physical mathematics), physics (mechanics, electromagnetism, thermal physics, quantum physics), basic experimental research, and information science.

b) Basic ability to understand and solve problems by applying the above knowledge and skills, and to present and discuss the subject effectively.

(2) Specialization

Requires advanced ability in at least one of the major fields within the scope of this discipline (physics or applied physics in general, material science, scientific measurement, and electronics and elements).

a) Advanced knowledge and skills acquired through a structured course of specialized classes that are necessary to achieve the objectives of the program.
b) Ability to apply the above knowledge and skills to explore and solve problems appropriately.
c) Ability to understand and solve practical problems encountered by professional engineers, by applying the above knowledge and skills, and to present and discuss the subject effectively.

2. Faculty

The program faculty should consist of member qualified to teach the relevant courses that are required in order to achieve the objectives of the program.

Refer to: The Japan Society of Applied Physics http://www.jsap.or.jp/activities/education/jabee/index.html

Program Criteria by Field for Environmental Engineering

These Program Criteria by Field apply to engineering programs in Environmental Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Fundamental ability to understand the basic philosophy of environmental management, environmental conservation, environmental improvement and restoration, and reducing environmental load, and ability to apply such knowledge appropriately to solve the relevant problems.

(2) Ability to observe, comprehend, and analyze phenomena related to environment.

(3) Knowledge and ability of applied (industrial) mathematics and natural science (at least two subjects mainly covering physics, chemistry, biology or geosciences).

(4) Fundamental knowledge of one of the following environmental engineering fields or integrated fields thereof.

1) Urban environment and environmental system (＊1
2) Social infrastructure and its environment (＊1
3) Housing and living environment (＊1
4) Material and energy environment (＊2
5) Other field related to environment (＊3

(5) Ability to plan and conduct research and experiment, as well as analyze, examine and explain the results in one or more environmental engineering related fields shown in the above (4).

(6) Ability to recognize environmental problems comprehensively utilizing knowledge and skills in the field specialized by the program, set up the task and solve it based on the appropriate process.

2. Faculty

Program faculty may include those who are qualified to teach subject matters by virtue of professional certification or practical engineering experiences.

＊1) Refer to: Japan Society of Civil Engineers http://www.jsce.or.jp/opcet/jabee/
＊2) Refer to: JABEE Committee for Chemical and Chemistry-Related Engineering
http://www.csj.jp/gaku/jabee/index.html
*3) Working Underway

Program Criteria by Field for Forest Engineering

These Program Criteria by Field apply to engineering programs in Forest Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Knowledge of fundamentals in forest engineering and natural environment, as well as knowledge in one or an integrated discipline of "Forest science", "Forest engineering", "Natural environment" and "Forest production", and ability to apply such knowledge to solve the problems.

(2) Ability to plan and carry out laboratory works and/or field investigation, to analyze the data, and to demonstrate the understanding through presentations.

(3) Ability to find out themes, to design proper methods, and to solve the problems with the professional knowledge in the discipline.

(4) Ability to understand and solve practical problems and themes of professional engineers.

2. Faculty

Program faculty may include those who are qualified to teach subject matters by virtue of professional certification or practical engineering experiences.

Refer to: Japan Association for Forest and Natural Environment Engineering Education

http://www.jafta.or.jp/jabee/

Program Criteria by Field for General and Combined Engineering

These Program Criteria by Field apply to engineering programs in General and Combined Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) General knowledge and abilities in Fundamental Engineering

Fundamental Engineering is comprised of the following 5 subjects groups:

[1] Systems Design/Planning; [2] Information & Logic Systems; [3] Materials & Bio-systems; [4] Mechanical Systems; and [5] Social Engineering.

Knowledge & Abilities in Fundamental Engineering are required in a minimum total of 6 subjects, including at least one subject in each of the above 5 groups.

(2) Knowledge & Abilities in Specialized Engineering

a) Knowledge & Abilities in Specialized Engineering: Concrete contents in the discipline of General and Combined Engineering should be established by applicant institutions.

b) Fundamental knowledge and technical skills in several fields of engineering that enable the student to freely plan & conduct experiments, precisely analyze data, and consider & persuasively explain results from an engineering point of view

c) Abilities to compile the basic knowledge & technical skills in engineering, and to show creativity in the exploration and analysis of problems & working out solutions

d) Fundamental ability of understanding technical and practical issues which might be experienced engineers and properly analyze and solve them.

2. Faculty

(1) Faculty is required to have proper technical qualifications, or demonstrated ability from practical teaching experience.

Refer to: Japanese Society for Engineering Education http://wwwsoc.nii.ac.jp/jsee/

Program Criteria by Field for Industrial Engineering and Management

These Program Criteria by Field apply to engineering programs in Industrial Engineering and Management.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Working ability and knowledge of principles and techniques for Management and Administration.

(2) Ability of mathematical analysis.

(3) Ability of applying Information Technology.

(4) Basic knowledge of Engineering, Economics, Management and related areas.

2. Faculty

(1) Program faculty should include member(s) qualified to teach the practical subject matter specified in the Industrial Engineering & Management and related disciplines.

Supplementary Explanations

The following is supplementary explanations to understand these Program Criteria by Field (1) – (4) above.

(1) The subject matter of business management is an organization in a broad sense and its entire system including people and information. Therefore, the program should demonstrate a clear concept of management that is appropriate in relation to this subject matter. And the program should aim at instilling methods, knowledge, and utilization capabilities of that concept of management. It is desirable if the programs instill a lateral perspective through the use of methodology, in addition to instilling technical subjects specific to the subject matter.

(2) This includes the abilities to: systematically collect data; analyze data considering probabilistic changes; use mathematical formulas to create models of actual problems; and find the most appropriate solutions.

(3) An example might be the ability on various levels to use and apply computers and other information technologies, including programming, system design, and network technologies.

(4) Basic knowledge related to Industrial Engineering and Management, such as specialized engineering technologies, interdisciplinary specialized technologies, social science, and other fields, are belong in this category.

Refer to: Japan Federation of Management Engineering Societies http://www.jsqc.org/fmes/

Program Criteria by Field for Information Engineering

These Program Criteria by Field apply to engineering programs in Information Engineering, including Engineering in Computer Science (CS), Computer Engineering (CE), Software Engineering (SE), Engineering in Information Systems (IS).

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Analyzing theories and problems, formulating them, and identifying the design solution in the next subject areas:

- ― Algorithms and data structures
- ― Computer system architecture and organization
- ― Information network
- ― Software design
- ― Concepts of programming languages

(2) Programming and practices

(3) Applying mathematics including discrete mathematics, probability and statistics

(4) Understanding fundamental and advanced subjects proper to the program and their applications

2. Faculty

The program faculty must include a sufficient number of teaching staffs who have had experience of developing an information processing system that was used by a third user and who have teaching capability to conduct successfully student projects which are parts of the program. Those must be dedicated to the program and help the students in learning the fundamentals and practices through the program.

Supplementary Explanations:

1) The Information Processing Society of Japan, the Institute of Electronics, Information, and Communication Engineers, and the Institute of Electrical Engineers are responsible for jointly conducting the evaluation of program in this discipline.

2) Concrete field in the discipline of Information Engineering (as CS, CE, SE, IS, etc.) and contents / objectives of educational program should be established by applicant institutions.

Refer to: Information Processing Society of Japan http://jabee.ipsj.or.jp/
The Institute of Electronics, Information and Communication Engineers
http://www.ieice.org/jpn/jabee/index.html
The Institute of Electrical Engineers of Japan http://www.iee.or.jp/eng_edu/

Program Criteria by Field for Materials and Metallurgical Engineering

These Program Criteria by Field apply to engineering programs in Materials and Metallurgical Engineering. Discipline of Materials and Metallurgical Engineering includes metals, inorganic materials (ceramics, glasses, etc.), organic materials (polymers, plastics etc.), composite materials, and semi-conducting materials, as well as their production, processing and application.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) Fundamental understanding of materials structure and materials properties.

(2) Fundamental understanding of materials processing.

(3) Fundamental understanding of materials performance, materials designs and materials selection.

(4) Fundamental ability to pursue the planning and practice of experiment and to analyze data.

For each of the items above (1), (2) and (3), contact hours must be secured more than 100 hours, and for the total of these three items more than 400 hours must be secured. And for item (4), it must be more than 200 hours.

Refer to: The Iron and Steel Institute of Japan http://www.isij.or.jp/Ikusei/jabee.htm

Program Criteria by Field for Mechanical Engineering

Revised in 2008

These Program Criteria by Field apply to engineering programs in Mechanical Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) For mathematics, capability in applying linear algebra and calculus, fundamental knowledge of probability theory and statistics. For natural science, fundamental knowledge of physics.

(2) Familiarity with fields that the Program regards as significant from the following main fields in mechanical engineering, and capability in applying them to solve problems.

- Materials and structures
- Dynamics and vibration
- Energy and fluid flows
- Information and measurement/control
- Design and manufacturing/management

(3) Capability in planning and conducting experiments / projects and analyzing and examining the results from the engineering standpoint.

2. Faculty

(1) The team of faculty (including part-time lecturer) must be comprised of those who have been qualified as professional engineers, or ones having abilities to teach practical engineering related to educational matters.

Supplementary Explanations

(A) The examples of keyword which describe the "main fields in mechanical engineering" referred to in article 1(2) and its quantitative guidelines are listed in the following table.

Table 1 Guidelines

Main field	Examples of keyword	Quantitative guideline
MATERIALS and STRUCTURES	○ Stress and Strain under Tensile, Compressive and Shearing Loadings ○ Elasticity and Plasticity ○ Strength of Materials and Allowable Stress ○ Structure of Materials	Curriculums in each program must contain more than 210 hours of lecture time on the main fields listed in the left column. The 210 hours of lecture time must include lecture time on more than 3 main fields.
MOTION and VIBRATION	○ Statics ○ Laws of motion ○ Free vibration ○ Forced vibration	
ENERGY and FLUID FLOWS	○ Quantity of State and Change of State ○ Conservations of Mass and Momentum ○ Conservation of Energy (The First Law of Thermodynamics and Bernoulli's Equation) ○ The Second Law of Thermodynamics ○ Heat Transfer and Temperature	
INFORMATION and MEASUREMENT/ CONTROL	○ Fundamentals of Computer Utilization ○ Fundamentals of Measurement Theory and Quantity Measurement Method ○ Transfer Function and Feedback Control ○ State Equation and State Feedback	
DESIGN and MANUFACTURING / MANAGEMENT	○ Design Methods ○ Drawing and Its Rules ○ Manufacturing Processes ○ Manufacturing / Management Systems	

(Note 1) It is not necessary that all students take the same lecture as a required subject. It should be confirmed that the graduate student of the program has completed sufficient lectures to satisfy the content description given above.

(B) Article 1(3) indicates experiments (with the aim of acquiring knowledge of experimental methods and how to operate apparatus) or projects such as graduation research (with the aim of learning to work with open-ended or creative themes), and more than 300 hours must be committed to this.

Refer to: The Japan Society of Mechanical Engineers http://www.jsme.or.jp/jabee/

Program Criteria by Field for Resources and Geological Engineering

These Program Criteria by Field apply to engineering programs in Resources and Geological Engineering.

1. Knowledge and abilities to be acquired

The graduates of the program must have acquired the following knowledge and abilities:

(1) The following knowledge and ability in one field of or an integrated field of three major fields of this discipline, i.e. "Geological engineering and disaster prevention", "Development and production of mineral and energy resources" and "Resources recycling and environmental conservation".

a) Specialized knowledge and ability

b) Ability to plan and conduct experiment and/or investigation and to analyze the data obtained, as well as to explain the results of consideration.

c) Ability to explore, examine, and solve problems by integrating a) and b).

d) Fundamental ability to understand and properly handle the subjects encountered by the engineers in this discipline.

2. Faculty

(1) The program faculty must include a faculty member qualified to teach the subject matter by virtue of professional licensure, or by education and design experiences.

Refer to: The Mining and Materials Processing Institute of Japan http://www.mmij.or.jp/