Accreditation Criteria for Engineering Programs

Developed according to the Graduate Attribute Exemplars of the Washington Accord

Version 2020

- Common Criteria
- Criteria Guide
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Document Control

The International Common Criteria and Criteria Guide version 2020 for Engineering Programs have been approved by IABEE Executive Committee on 16 January 2020.

This 2020 version document replaces the version published in 2015. Changes made in this version are as follows:

- Overall grammatical checks and revisions,
- Inclusion of definition of parallel Programs in accordance to the PSDKU (*Program Studi di Luar Kampus Utama*) scheme,
- Addition of the modifier 'complex engineering problem' in graduate competence criterion point (d),
- Simplification of Criteria Guide for sub-criterion 2.3.2.,
- Addition of facility safety aspect in the description of sub-criterion 2.4.,
- Editorial restructuring of Criteria Guide for sub-criterion 3.1., and
- Editorial restructuring of Criteria Guide for sub-criterion 3.2.

Contents

Common Criteria

Preamble

The Indonesian Accreditation Board for Engineering Education (IABEE) builds this set of Criteria using outcome-based education approach. All engineering education programs seeking international accreditation from IABEE shall fulfill the following Criteria.

1. Orientation of the Graduate Competence

1.1. Program shall define the profile of graduates to be envisaged as autonomous professionals by considering country's potential resources, cultures, needs and interests.

1.2. Program shall inform its students and faculty with the envisaged autonomous professional profile and widely publicize it.

1.3. Program shall establish its expected Learning Outcomes which consist of abilities to utilize knowledge, skills, resources and attitudes as described in the following (a) to (j) items to be acquired by the student at the time of completion of the study:

(a) an ability to apply knowledge of mathematics, natural and/or materials sciences, information technology and engineering to acquire comprehensive understanding of engineering principles,

(b) an ability to design components, systems, and/or processes to meet desired needs within realistic constraints in such aspects as law, economic, environment, social, politics, health and safety, sustainability as well as to recognize and/or utilize the potential of local and national resources with global perspective,

(c) an ability to design and conduct laboratory and/or field experiments as well as to analyze and interpret data to strengthen the engineering judgment,

(d) an ability to identify, formulate, analyze, and solve complex engineering problems,

(e) an ability to apply methods, skills and modern engineering tools necessary for engineering practices,

(f) an ability to communicate effectively in oral and written manners,

(g) an ability to plan, accomplish, and evaluate tasks under given constraints,

(h) an ability to work in multidisciplinary and multicultural team,

(i) an ability to be accountable and responsible to the society and adhere to professional ethics in solving engineering problems, and

(j) an ability to understand the need for life-long learning, including access to the relevant knowledge of contemporary issues.

2. Learning Implementation

2.1. Curriculum

2.1.1. Curriculum shall include the following subject areas:

(a) Mathematics and discipline-specific natural sciences

(b) Discipline-specific engineering science and technology

(c) Information and communication technology

(d) Engineering design and problem based experiments

(e) General education, which includes morality, ethics, socio-culture, environment and management

2.1.2. Curriculum development shall consider input from Program stakeholders.

2.1.3. Curriculum shall indicate the structural relationship and contributions of the subject courses to fulfill Learning Outcomes. Procedures, including syllabus, shall be established and documented so that the expected learning process can be implemented in a controlled way.

2.1.4. Curriculum shall ensure that the students are exposed to engineering practices and major design project experience using engineering standards and multiple realistic constraints based on knowledge and skills acquired in preceding course work.

2.2. Faculty

2.2.1. The Program shall provide necessary number, qualification and competence of faculty members for performing learning process, including planning, delivering, evaluating, and continually improving its effectiveness in order to achieve the Learning Outcomes.

2.2.2. The Program shall ensure that faculty members are aware of the relevance and importance of their roles and contributions to the Learning Outcomes.

2.3. Students and Academic Atmosphere

2.3.1. The Program shall define and implement an entry standard for both new and transfer students, as well as transfer of credits.

2.3.2. Program shall define and implement ongoing monitoring of student progress and evaluation of student performance. Procedures of quality assurance shall be established to ensure that adequacy of standards is achieved in all assessments.

2.3.3. The Program shall create and maintain good academic atmosphere conducive to successful learning.

2.3.4. The Program shall promote co-curricular activities for character building and enhancing the students' awareness on the country's needs.

2.4. Facilities

Program shall ensure the availability, accessibility, and safety of facilities for effective functioning of the learning process and attainment of the Learning Outcomes.

2.5. Institutional Responsibility

2.5.1. The Program shall define and manage the process for the provision of the educational service, including education design, curriculum development and delivery, and assessment of learning.

2.5.2. The Program Operating Institution shall make efforts to establish resources, supporting service and cooperation with stakeholders on research, education and/or service to community with due consideration to existing local resources.

3. Assessment of the Learning Outcomes

3.1. The Program shall ensure that an effective assessment process of Learning Outcomes based on established performance indicators is implemented and maintained at planned intervals using appropriate methods.

3.2. The Program shall ensure that graduates of the program achieve all expected Learning Outcomes.

4. Continual Improvement

4.1. Based on Program Learning Outcomes assessment results, the Program shall perform an evaluation at planned intervals with output in the form of decisions to improve the effectiveness of the educational process and resources.

4.2. The Program shall maintain documents and records related to the implementation of evaluation, the results and their follow-up.

Criteria Guide

0. Preamble

The Indonesian Accreditation Board for Engineering Education (IABEE) establishes this set of Criteria using outcome-based education approach. All engineering education programs seeking international accreditation from IABEE shall fulfill the following Criteria.

0.1. IABEE Common Criteria (CC) are established as a framework to perform accreditation of higher education programs. These CC comprise of elements that must be fulfilled by the Study Program to be accredited.

0.2. Programs to be accredited are four-year engineering Bachelor Programs or other higher education programs which IABEE considers as equivalent.

0.3. The Program is not restricted to single Programs operated by a Department or Faculty. A Program may be formed and/or operated by multiple Departments / Faculties. Programs may include matriculated learning activities outside of its home campus, in conjunction with other higher education institutions.

0.4. In cases where a Program is offered as parallel classes, evaluation by IABEE shall encompass all parallel classes. In cases where multiple Programs of the same nomenclature are offered in multiple locations by the same Program-Operating Institution (such as Programs established according to the *Program Studi di Luar Kampus Utama* (PKSDU) scheme as defined by the Indonesian Ministerial Regulation of *Peraturan Menteri Riset, Teknologi, dan Pendidikan Tinggi* No. 1/ 2017), evaluation by IABEE shall treat the parallel Programs as separate entities.

0.5. The Program shall define the profile of autonomous professionals to be fostered, and define the knowledge, skills, and attitudes as Learning Outcomes that graduates are expected to master upon completion of their study.

0.6. The Program should promote self-reliance, welfare, advancement, fairness and justice for the national and global community in general, based on science, technology, culture and sustainable utilization of natural resources.

0.7. The Program is required to design the curriculum systematically to ascertain the achievement of Program Learning Outcomes. Student and faculty should be aware of these Learning Outcomes.

0.8. The Program must disclose its Learning Outcomes to the public. The Program is also required to engage in continual improvement and at the same time to consider the sustainability of operation.

0.9. Common Criteria consist of 4 elements, following the management approach of PDCA (Plan-Do-Check-Act) continual improvement cycle. Criterion 1 describes the orientation of the graduate competence, Criterion 2 explains the learning implementation, Criterion 3 explains the assessment of the expected Learning Outcomes, and Criterion 4 explains the continual improvements.

0.10. In addition to these Common Criteria, Program seeking for accreditation shall fulfill also the Category and Discipline Criteria, as well as eligibility requirements and accreditation policies stipulated in the Rules and Procedures of Evaluation and Accreditation (RPEA).

1. Orientation of the Graduate Competence

1.1. The Program shall define the profile of graduates to be envisaged as Autonomous Professionals by considering country's potential resources, cultures, needs and interests.

1.1.1. The Program is required to define the Profile of the Autonomous Professionals intended to foster as its educational objectives, by taking account of:

(1) Local and/or national resources, such as human and physical resources.
(2) Local and/or national wisdoms,
(3) Local and national needs and interests
(4) Traditions, vision and mission of the education institution

1.1.2. The Program should demonstrate the process of establishing and periodic reviewing of the Autonomous Professional Profiles, including the involvements of the stakeholders.

1.2. The Program shall inform its students and faculty of the envisaged Autonomous Professional Profile and widely publicize it.

1.2.1. The envisaged Autonomous Professional Profile shall be informed to students and faculty and made accessible to the general public.

1.3. The Program shall establish its expected Learning Outcomes which consist of abilities to utilize knowledge, skills, resources and attitudes as described in the following (a) to (j) graduate competences to be acquired by the student at the time of completion of the study.

1.3.1. The Program shall establish its own Program Learning Outcomes based on the Autonomous Professional Profile to be acquired. The Learning Outcomes shall cover all graduate competences from (a) to (j) as referred to in Common Criteria 1 (3), which are expressed in such a way to provide flexibility to Program. It is important to note that the Learning Outcomes shall also include Category and Discipline Criteria

1.3.2. The Program shall establish procedures to conduct periodic review of the Learning Outcomes.

1.3.a. Ability to apply knowledge of mathematics, natural and/or materials sciences, information technology and engineering to acquire comprehensive understanding of engineering principles.

1.3.a.1. Engineering Principles refers to ideas, rules and concepts to be considered when solving an engineering problem. The set of principles may vary among engineering disciplines depending on the uniqueness of systems, problems, ethical issues, and problem-solving methods of the discipline.

1.3.a.2. Attainment of comprehensive understanding of engineering principles is indicated by mastery of mathematics, basic sciences (such as physics, biology, chemistry) and information technology relevant to the discipline of the Program, and the ability to utilize the aforementioned knowledge.

1.3.b. Ability to design components, systems, and/or processes to meet desired needs within realistic constraints in such aspects as law, economic, environment, social, politics, health and safety, sustainability as well as to recognize and/or utilize the potential of local and national resources with global perspective.

1.3.b.1. The ability to design components, systems, and/or processes is the hallmark competence of engineering education. Design implies the ability to utilize multidimensional thinking with knowledge of global perspective to develop components, systems, and/or processes to achieve specific objectives. It is not limited to drawing a plan, but also refers to the synthesis of various academic disciplines and technologies to pursue practicable solutions to a problem that does not necessarily have one correct answer.

1.3.b.2. Design also involves a process of optimization which considers multiple realistic constraints, such as law, economic, environment, social, politics, health and safety, and sustainability as well as utilization of the knowledge of culture, society and available resources.

1.3.c. Ability to design and conduct laboratory and/or field experiments as well as to analyze and interpret data to strengthen the engineering judgment.

1.3.c.1. This competence refers to the design and application of laboratory and/or field experiments within the broad context of engineering practice such as problem identification, testing of potential solution ideas, solution implementation plan, and other design-related activities.

1.3.c.2. Experiments may include activities in physical laboratories, computer simulations, and field experiments.

1.3.d. Ability to identify, formulate, analyze, and solve complex engineering problems.

1.3.d.1. Engineering problem solving involves iterative activities incorporating the definition of the problem, development of solution alternatives, selection of best alternative, application of solution, evaluation and validation of solution against multiple problem constraints, and revision of solution.

1.3.d.2. This competence should include the ability to:

- utilize techniques and methods for performing engineering works comprising survey, data analysis, planning, design, operation and maintenance.
- apply the engineering logical thinking for handling both of the design and troubleshooting context.
- utilize creative/innovative thinking and knowledge creation/co-creation skills.

1.3.e. Ability to apply methods, skills and modern engineering tools necessary for engineering practices

1.3.e.1. The Program shall have a clear definition of the methods, skills, and modern engineering tools appropriate for its level of study and engineering discipline, and how these are learnt throughout the curriculum. This definition shall include:

- ability to select a method and tools with their strength and limitation characteristics for a given problem
- ability to utilize and adjust the method and tools to suit specific problems

1.3.f. Ability to communicate effectively in oral and written manners

1.3.f.1. This competence indicates the need of active and effective communication skills; socio-cultural perspective should be considered for the acceptability and workability of the implementation of engineering works.

1.3.f.2. These oral and written communications should include the use of engineering standards.

1.3.f.3. The Program shall ensure that a measurable portion of the oral and/or written communications involve the use of internationally recognized languages.

1.3.g. Ability to plan, accomplish, and evaluate tasks under given constraints

1.3.g.1. This competence refers to the ability to plan, accomplish, and evaluate tasks associated with any curricular activity deemed appropriate by Program for its assessment and evaluation. The assessment should focus more on the students' task management skills rather than the substantial outcome of the task itself.

1.3.h. Ability to work in multidisciplinary and multicultural teams

1.3.h.1. This competence refers to the ability to work collaboratively with people from different technical disciplines, fields and cultural backgrounds.

1.3.h.2. Multicultural concerns such as tolerance, mutual understanding, appreciation on differences in building a synergy, are important considerations for the success of a teamwork.

1.3.h.3. Multidiscipline circumstances may cover disciplines within engineering and non-engineering disciplines.

1.3.i. Ability to be accountable and responsible to the society and adhere to professional ethics in solving engineering problems

1.3.i.1. This competence refers to the understanding on the following issues and the ability to elaborate, discuss, present argument, and/or respond accordingly:

- the impact of technology of related engineering fields on public welfare, environmental safety and sustainable development
- the engineering ethics and regulations
- the engineering history and standard & code philosophy in design.

1.3.j. Ability to understand the need for life-long learning, including access to the relevant knowledge of contemporary issues

1.3.j.1. The Program is required to assist students to become accustomed to independent and continuous learning through lectures, research, experiments, practical training, exercises and assignment.

1.3.j.2. This competence refers to understanding the necessity of continuous professional development, an ability to acquire updated information and knowledge, and an awareness of the importance of sharing knowledge.

2. Learning Implementation

2.1. Curriculum

2.1.1. Curriculum of the Program shall include the following subject areas:

a) Mathematics and discipline-specific natural sciences

b) Discipline-specific engineering science and technology

c) Information and communication technology

d) Engineering design and problem-based experiments

e) General education, which includes morality, ethics, socio-culture, environment and management

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2.1.1.1. The Program shall ensure that the curriculum meets the abovementioned subject areas appropriate to engineering regardless of the subject/course names. The Program must ensure that the curriculum devotes adequate attention and time to each component, consistent with the Program Learning Outcomes, which include (expressed as percentage of total coursework load in semester credits (SKS)):

- A minimum of 20% of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as courses such as biological, chemical, or physical sciences.
- A minimum of 40% of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study. The engineering sciences have their roots in mathematics and basic sciences but carry knowledge further toward creative application. These studies provide a bridge between mathematics and basic sciences on the one hand and engineering practices on the other. Engineering design is the process of devising a system, component, or process to meet desired needs. It is a decision-making process, in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet the stated needs.
- A maximum of 30% general education components that complement the technical content of the curriculum and are consistent with the Learning Outcomes.

2.1.2. Curriculum development shall consider input from Program stakeholders.

2.1.2.1. The Program should demonstrate on how to develop the curriculum and to assure the requirement of the society, industry and professional fields.

2.1.2.2. There must be a documented, systematically utilized, and effective procedure describing the way to meet the need of stakeholders and to review the curriculum periodically to ensure its consistency with the institutional mission, the stakeholders needs, and these criteria.

2.1.2.3. The Program should provide sufficient opportunity for the stakeholders to discuss Program educational objectives/Profile of Autonomous Professionals, and to foster closer collaboration.

2.1.3. The Curriculum must indicate the structural relationship and contributions of the subject courses to fulfill Learning Outcomes. Procedures, including syllabus, shall be established and documented so that the expected learning process can be implemented in a controlled way.

2.1.3.1. The Program shall describe how the curriculum content and structure are aligned to enable the attainment of Program Learning Outcomes by students.

2.1.3.2. The Program should describe how specific requirements of each curricular area in Common Criteria or Discipline Criteria can be met, both in terms of load and depth of the curricular content.

2.1.3.3. The Program shall establish syllabi for all courses designed to satisfy mathematics, science, and discipline-specific requirements or any applicable criteria.

2.1.3.4. The Program is required to implement educational activities for students to achieve its Program Learning Outcomes.

2.1.3.5. The Program is required to systematically design curriculum to enable students to achieve the expected Program Learning Outcomes within the intended period of study.

2.1.3.6. The Program is required to adequately inform the faculty and students through various means such as guidebooks, orientation programs etc. about the curriculum, and how the Program Learning Outcomes will be attained through the learning process.

2.1.4. The Curriculum shall ensure that students are exposed to engineering practices and major design project experience which incorporates engineering standards and multiple realistic constraints based on knowledge and skills acquired in preceding coursework.

2.1.4.1. The Program must provide opportunity to students to develop competence in practical application of engineering skills, combining theory and experience along with the use of other relevant knowledge and skills. Training in engineering practices may be supported by several courses (subjects) but should culminate in a major design project. This major project serves as a capstone for the program which requires students to integrate knowledge and skills acquired in earlier coursework.

2.1.4.2. The Program shall define curriculum subjects to optimally support mainstream discipline specific requirements and to provide opportunity for students to acquire practical experience in implementing the subjects in an actual working environment.

2.2. *Faculty*

2.2.1. The Program shall provide necessary number, qualification and competence of faculty members for performing learning process, including planning, delivering, evaluating, and continually improving its effectiveness in order to achieve the Learning Outcomes.

2.2.1.1. The Program shall describe qualifications of the faculty and their adequacy to cover all curricular areas and to meet any applicable criteria.

2.2.1.2. This description should include the composition, size, experience and the extent and quality of faculty member involvement in interactions with students, student advising, and oversight of the Program.

2.2.1.3. The Program shall provide detailed descriptions of professional development activities for each faculty member and how activities such as sabbaticals, travel, workshops, seminars, etc., are planned and supported.

2.2.2. The Program shall ensure that faculty members are aware of the relevance and importance of their roles and contributions to the Learning Outcomes.

2.2.2.1. The Program shall describe the role played by the faculty with respect to the course creation, modification, and evaluation, and with respect to the definition, revision and attainment of the Learning Outcomes.

2.2.2.2. The Program shall have a method to institutionally develop and evaluate faculty educational activities.

2.2.2.3. The Program shall define and set up communication network among faculty members for close collaboration among the courses set in the curriculum to obtain better educational results.

2.3. Students and Academic Atmosphere

2.3.1. The Program shall define and implement an entry standard for both new and transfer students, as well as transfer of credits.

2.3.1.1. The Program shall establish written policies on student admission, covering the requirements and the process for accepting new students into Program, including information on how Program ensures and documents that students are meeting prerequisites and how it handles cases where prerequisite have not been met.

2.3.1.2. The Program shall describe the requirements and process for accepting transfer students and transfer credits.

2.3.2. Program shall define and implement ongoing monitoring of student progress and evaluation of student performance. Procedures of quality assurance shall be established to ensure that adequacy of standards is achieved in all assessments.

2.3.2.1. The Program shall establish policies and procedures to monitor students' progress and performance

2.3.2.2. The Program shall document the process by which student performance is monitored.

2.3.3. The Program shall create and maintain good academic atmosphere conducive to successful learning.

2.3.3.1. The Program shall develop supporting activities to create and maintain good academic atmosphere for learning, such as by providing student guidance and counseling on academic as well as non-academic aspects and career guidance.

2.3.3.2. The Program shall describe the process for advising and providing career guidance to students, how often students are advised, and who provides the advising.

2.3.4. The Program shall promote co-curricular activities for character building and enhancing the students' awareness on the country's needs.

2.3.4.1. The Program shall create and maintain various co-curricular activities particularly to improve the student soft skills, such as conducting *studium generale*, involving student in faculty research projects, and participating in scientific forums.

2.3.4.2. An entrepreneurial spirit as characterized by a deep sense of purpose, perseverance, resourcefulness, open-mindedness, and eagerness to learn should be emphasized in the learning process.

2.4. Facilities

2.4.1. Program shall ensure the availability, accessibility, and safety of facilities for effective functioning of the learning process and attainment of the Learning Outcomes.

2.4.1.1. The Program shall describe the facilities in terms of their ability to support the attainment of the Learning Outcomes and to provide an atmosphere conducive to learning, such as:

- offices (such as administrative, faculty, clerical, and teaching assistants) and any associated equipment,
- classrooms and associated equipment,
- in house laboratory facilities including those containing computers (describe available hardware and software) and the associated tools and equipment that support instruction, and field laboratory whenever necessary
- computing resources (workstations, servers, storage, networks including software)
- library services.

2.4.1.2. The Program shall describe and assess the adequacy of these facilities to support the scholarly and professional activities of the students and faculty.

2.4.1.3. The Program shall describe how students are provided with appropriate guidance regarding the use of tools, equipment, computing resources, laboratories, and other physical facilities to enable the utilization of these facilities in a safe and appropriate manner.

2.4.1.4. The Program shall also describe the policies and procedures for maintaining and upgrading the tools, equipment, computing resources, laboratories, library and other facilities used by students and faculty.

2.5. Institutional Responsibility

2.5.1. The Program shall define and manage the process for the provision of the educational service, including education design, curriculum development and delivery, and assessment of learning.

2.5.1.1. The Program shall describe the governance of the program and its adequacy to ensure the quality and continuity of the program and how the leadership is involved in decisions that affect the Program.

2.5.1.2. The Program shall describe the process used to establish the program's budget and provide evidence of continuity of institutional support for the program, including the sources of financial support for both permanent (recurring) and temporary (one-time) funds.

2.5.1.3. The Program shall describe how teaching is supported by the institution in terms of graders, teaching assistants, teaching workshops, etc.

2.5.1.4. The Program shall describe the adequacy of the staff (administrative, instructional, and technical) and institutional services provided to the Program.

2.5.2. The Program Operating Institution (POI) shall make efforts to establish resources, supporting service and cooperation with stakeholders on research, education and/or service to community with due consideration to existing local resources.

2.5.2.1. The POI shall make efforts to develop partnership with external institutions such as industry, research centers, and community units to foster the *Tridharma* (learning, research, and community engagement).The institution hosting the Program shall demonstrate the support to these efforts.

2.5.2.2. The improvement of the students' learning process through the engagement of academia, business, and/or the government in the development of local region through the use of local resources is viewed as a particular advantage of the Program.

3. Assessment of the Learning Outcomes

3.1. The Program shall ensure that an effective assessment process of Learning Outcomes based on established performance indicators is implemented and maintained at planned intervals using appropriate methods.

3.1.1. The Program shall define for each Learning Outcome the relevant performance indicators and appropriate assessment method as the basis for measuring achievements of these indicators.

3.1.2. A complete and clearly documented method and procedure for measuring the achievement of Learning Outcomes shall be established.

3.1.3. The assessment of each learning outcome shall be conducted at planned interval.

3.2. The Program shall ensure that graduates of the program achieve all expected Learning Outcomes.

3.2.1. The Program shall maintain effective policy and procedures to ensure that its graduates meet all graduation requirements.

3.2.2. The process and results of graduation requirement review shall be documented and the records are maintained as evidence that all graduates have been evaluated and that all Program Learning Outcomes have been fulfilled.

3.2.3. The Program shall have written policies and procedures on how handle non-performing students and how to terminate students who are not able to complete their study.

4. Continual Improvement

4.1. Based on Program Learning Outcomes assessment results, the Program shall perform an evaluation at planned intervals with output in the form of decisions to improve the effectiveness of the educational process and resources.

4.1.1. To ensure the continual improvement, the Program should run its educational activities by implementing a quality assurance system follows the P-D-C-A cycle as described in the preamble.

4.1.2. The evaluation shall be based on assessment of the Program Learning Outcomes attainment. The output of the evaluation shall contain recommendations on the improvement of learning materials, methods of delivery and other educational processes, suitability and adequacy of the Learning Outcomes with regards to the needs of stakeholders, and resources.

4.1.3. The evaluation shall be carried out at planned intervals following a method and procedure made well-known to the faculty. The evaluation method and procedure should be designed to enable the identification of constraints and root causes of problems, and therefore resulting in opportunities for improvement.

4.2. The Program shall maintain documents and records related to the implementation of evaluation, the results and their follow-up.

4.2.1. A documented procedure for the implementation of Program evaluation shall be established.

4.2.2. The documentation of evaluation implementation, its results and its follow-up shall be maintained and accessible to the faculty. These records provide evidence that evaluation has been conducted, the results have been implemented and periodic improvement has been achieved, thereby signifying the implementation of P-D-C-A cycle.

Discipline Criteria

Discipline Criteria for Agricultural and/or Bio-Systems Engineering in Bachelor Programs

Lead Society(ies):

- *Badan Kejuruan Teknik Pertanian Persatuan Insinyur Indonesia* (BKTP PII) – PII Chapter for Agricultural Engineers

These Discipline Criteria apply to bachelor programs that include "agricultural engineering", "bio-system engineering," "bio-production engineering", and similar modifiers in their titles.

Curriculum

The curriculum shall provide fundamental knowledge of engineering principles, agriculture and/or biosystem related sciences and ability to apply them to analyze, interpret, identify alternative solutions, and implement experiments for enhancing the performance agricultural systems or solution of common problems in agriculture and/or biosystem.

The learning and educational process articulating in the curriculum must be conducted in such a way to ensure that the graduates have sufficient knowledge, skill and attitude in the process to identify, analyze, formulate, design, use and control of machinery, structure and systems to solve engineering problems as required in the production of plant and animal, processing and handling the agricultural and/or biological materials.

The curriculum content that be considered as "educational components of mathematics, natural sciences and technologies" appropriate to the field shall include systematic subject clusters related with mathematics and natural sciences (focusing on multiple subjects such as, physics, chemistry, biology, or geography), and area of agricultural meteorology, irrigation, drainage and reclamation engineering (agricultural civil and environmental engineering), and/or area of agricultural machinery & automation, and/or area of agricultural work system and safety, and/or area of agricultural/biological production system, and/or area of agriculture/biological and environment information.

To conduct the learning and educational process the program shall be considered as "to provide a sufficient number of faculty members able to realize the curriculum with applicable educational methods and to improve the educational result of the program, and shall provide the faculty with institutional support."

Discipline Criteria for Agro-Industrial and Similarly-named Engineering Programs

Lead Society(ies):
○ *Badan Kejuruan Industri Pertanian Persatuan Insinyur Indonesia* (BKIP PII) – PII Chapter for Agro-Industrial Engineers
○ *Forum Komunikasi Program Studi Industri Pertanian Indonesia* (FKPSIP) -

These Discipline Criteria apply to engineering programs that include “agro-industrial” and similar modifiers in their titles

Curriculum

The curriculum prepares graduates with ability to design, develop, implement, control, evaluate, and improve the system performance of sustainable agroindustry, through an integrated approach of transformation process, system engineering, industrial management, and environmental aspects to increase the added value of agricultural/bio-based resources and their derivatives.

Faculty

Faculty members are required to have a combined expertise in the aspects of transformation, systems engineering, industrial management, and environment for developing sustainable and integrated agro-industrial system.

Discipline Criteria for Chemical, Biochemical, and Similarly-named Engineering Programs

Lead Society(ies):
○ *Asosiasi Pendidikan Tinggi Teknik Kimia Indonesia* (APTEKINDO) – Association of Indonesian Higher Education Programs in Chemical Engineering
○ *Badan Kejuruan Kimia Persatuan Insinyur Indonesia* (BKK PII) – PII Chapter for Chemical Engineers

These Discipline Criteria apply to engineering programs that include "chemical", "biochemical", "bioprocess", "bioenergy", and similar modifiers in their titles.

Curriculum

The curriculum shall provide a firm grasp in basic sciences which include chemistry and chemistry-related sciences, physics, and/or biology with some reference to local context as appropriate to the objectives of the Program. The curriculum must include the engineering application of these basic sciences to the design, analysis, and control of chemical, physical, and/or biological processes and the design and development of products, including the economics and hazards associated with these processes and products.

The learning process articulating this curriculum must be conducted in such a way to ensure that the graduates have sufficient knowledge, skills, and attitude in the process design, analysis, and control, and product design and development. The learning process must also enable students to apply research-based knowledge and research methods to identify, formulate, and solve engineering problems.

Discipline Criteria for Civil and Similarly-named Engineering Programs

Lead Society(ies):

- *Badan Kejuruan Teknik Sipil Persatuan Insinyur Indonesia* (BKTS PII) – PII Chapter for Civil Engineers

These Discipline Criteria apply to bachelor programs that include "civil engineering" and similar modifiers in their titles.

Curriculum

The program shall prepare graduates to be proficient in applied mathematics and natural sciences relevant to civil engineering, in a minimum of three recognized major civil engineering areas (namely structural, project management, geotechnical, water resources, environmental, and transportation), in conducting civil engineering experiments and analyzing and interpreting the resulting data, and in designing and integrating all professional components of the curriculum. The program shall also prepare graduates to explain basic concepts in management, business, public policy, and leadership, and explain the importance of ethics and professional licensure.

Faculty

Faculty members teaching courses on design should have either certification of professional engineer or qualification through experience in engineering design and practices.

Discipline Criteria for Earth and Energy Engineering Programs

Lead Society(ies):
○ *Badan Kejuruan Teknik Kebumian dan Energi* PII – PII Chapter for Earth and Energy Engineers
○ *Ikatan Ahli Geologi Indonesia* – Association of Geological Experts Indonesia
○ Himpunan Ahli Geofisika Indonesia – Association of Geophysical Experts Indonesia

Curriculum

The program shall prepare graduates to be proficient in applied mathematics and natural sciences relevant to earth and energy engineering, such as geological engineering, geophysical engineering, or other scope related to earth and energy engineering mapping, in conducting earth and energy engineering data acquisition, data processing and interpretation for experiments and research toward design and planning of engineering or exploration purpose, in which it integrates all professional components in the curriculum. The program shall also prepare graduates to explain basic concepts in management, business, public policy, and leadership, and explain the importance of ethics and professional licensure.

Faculty

Faculty members teaching courses should have either certification in related earth and energy engineering profession, or professional engineer or qualification through experience in engineering practice.

Discipline Criteria for Electrical, Computer, Communications, Telecommunication and Similarly-named Engineering Programs

Lead Society(ies):
○ *Forum Pendidikan Tinggi Teknik Elektro Indonesia* (FORTEI) – Indonesian Forum for Higher Education in Electrical Engineering
○ *Badan Kejuruan Elektro Persatuan Insinyur Indonesia* (BKE PII) – PII Chapter for Electrical Engineers

These Discipline Criteria apply to engineering programs that include "electrical", "electronic(s)," "computer," "communication(s)," "telecommunication(s)," or similar modifiers in their titles.

Curriculum

The curriculum specifies subject areas appropriate to engineering and must include:

a. 30 credits minimum of a combination of university level mathematics and basic sciences (one with experimental experience) appropriate to the discipline.

b. 45 credits minimum of engineering topics, i.e. engineering sciences and engineering design, appropriate to the title of the program.

Students must be prepared for engineering practice through a curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work to meet desired needs within realistic constraints.

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

The curriculum must include probability and statistics, with applications appropriate to the program name; mathematics through differential and integral calculus; basic sciences and engineering topics (including computing science) necessary to analyze and design complex electrical/electronic devices or systems containing hardware and/or software components.

The curriculum for programs containing the modifier "electrical," "electronic(s)," "communication(s)," or "telecommunication(s)" in the title must include advanced mathematics, such as differential equations, linear algebra, and complex variables.

The curriculum for programs containing the modifier "computer" in the title must include discrete mathematics.

The curriculum for programs containing the modifier "communication(s)" or "telecommunication(s)" in the title must include topics in communication systems.

The curriculum for programs containing the modifier "telecommunication(s)" must include design and operation of telecommunication networks for services such as but not limited to voice, data, image, and video transport.

Discipline Criteria for Engineering Physics and Similarly-named Engineering Programs

Lead Society(ies):

- *Badan Kejuruan Teknik Fisika Persatuan Insinyur Indonesia (BKTF PII)* – PII Chapter for Engineering Physics

These Discipline Criteria apply to bachelor programs that include "engineering physics" and similar modifiers in their titles.

Curriculum

The program must prepare graduates to engage in the development of the forefront of technology, such as and not limited to, instrumentation & control, built environment and energy systems, material design and processing, renewable energy

The curriculum must provide strong fundamentals on mathematics, physics, engineering sciences and engineering design. The curriculum should cover the capability to thrive in professional and industry sectors, such as engineering economics, project management and core competences of the forefront technology.

Faculty

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

Discipline Criteria for Environmental and Similarly-named Engineering Programs

Lead Society(ies):
○ *Badan Kejuruan Teknik Lingkungan Persatuan Insinyur Indonesia* (BKTL PII) – PII Chapter for Environmental Engineers
○ *Ikatan Ahli Teknik Penyehatan dan Lingkungan Indonesia* (IATPI) – Indonesian Association of Experts in Sanitation and Environmental Engineering
○ *Badan Kerja Sama Perguruan Penyelenggara Pendidikan Tinggi Teknik Lingkungan* (BAKERMA-TL) – Association of Higher Education Programs in Environmental Engineering

These Discipline Criteria apply to engineering programs that include "environmental" and similar modifiers in their titles.

Curriculum

The curriculum must prepare graduates to apply knowledge of mathematics and basic sciences; introductory level knowledge of environmental issues associated with air, land, and water systems and associated environmental health impacts; conduct laboratory experiments and analyze and interpret the resulting data in more than one major environmental engineering focus area, (e.g., air, water, land, environmental health); performing design of environmental engineering systems; understanding in advanced principles and practice relevant to the program objectives. The curriculum must prepare graduates to understand concepts of professional practice, project management, and the roles and responsibilities of public institutions and private organizations pertaining to environmental policy and regulations.

Faculty

The program must demonstrate that a majority of those faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, board certification in environmental engineering, or by education and equivalent design experience.

Discipline Criteria for Geodetics, Geomatics, and Similarly-named Engineering Programs

Lead Society(ies):

- *Forum Ketua Jurusan dan Program Studi Teknik Geodesi-Geomatika se-Indonesia* – Indonesian Forum for Higher Education in Geodetic-Geomatics Engineering

These Discipline Criteria apply to engineering programs that include "surveying," "geodetic," "geomatics", and similar modifiers in their titles.

Curriculum

The curriculum must prepare graduates to apply knowledge of mathematics, natural sciences and statistics in Geodetics/Geomatics engineering field, complete task related to spatial data acquisition using modern measurement tools, perform geospatial data processing using industry-standard software, and also perform standard analysis and design in at least one of the recognized technical specialties within surveying/geodetics/geomatics technology, include boundary and/or land surveying, geographic and/or land information systems, engineering project surveying, photogrammetry, remote sensing, mapping and geodesy, and other related areas.

Faculty

The program must demonstrate that a majority of those faculty members are qualified to teach engineering courses by education, equivalent design experience or board certification of a surveyor professional/geomatics engineering.

Discipline Criteria for Industrial and Similarly-named Engineering Programs

Lead Society(ies):
○ *Badan Kerja Sama Penyelenggara Pendidikan Tinggi Teknik Industri Indonesia (BKSTI)* – Indonesian Association of Higher Education in Industrial Engineering
○ *Badan Kejuruan Teknik Industri Persatuan Insinyur Indonesia* (BKTI PII) – PII Chapter for Industrial Engineers

Curriculum

The program shall prepare graduates to be proficient in design, improve, and implement integrated systems that include people, materials, equipment, energy and information. To meet these needs, the curriculum must provide adequate knowledge about the application of mathematics, statistics and probabilistic theory as well as analysis and design engineering as well as knowledge with regard to social sciences. The education program should ensure the provision of an integrated system design experiences to students. The curriculum must include in depth instruction to accomplish the integration of systems using appropriate analytical, computational and experimental practices.

Faculty

Faculty members must understand the professional practice and maintain currency in their respective professional areas. Faculty members must be responsible and able to make the definition, evaluation, implementation and improvement on the achievement of Learning Outcomes in the framework of an continuous improvement of the study program.

Discipline Criteria for Materials, Metallurgical and Similarly-named Engineering Programs

Lead Society(ies):
○ *Badan Kejuruan Teknik Material Persatuan Insinyur Indonesia* – PII Chapter for Material Engineers
○ *Badan Kejuruan Teknik Metalurgi Persatuan Insinyur Indonesia* – PII Chapter for Metallurgical Engineers

These Discipline Criteria apply to engineering programs including "materials," "metallurgical," "ceramics," "glass", "polymer," "biomaterials," and similar modifiers in their titles.

Curriculum

The curriculum must prepare graduates to apply advanced science (such as chemistry, biology and physics), computational techniques and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, biomaterials, composite materials; to integrate the understanding of the scientific and engineering principles underlying the four major elements of the field: structure, properties, processing, and performance related to material systems appropriate to the field; to apply and integrate knowledge from each of the above four elements of the field using experimental, computational and statistical methods to solve materials problems including selection and design consistent with the program educational objectives.

Faculty

The faculty expertise for the professional area must encompass the four major elements of the field.

Discipline Criteria for Mechanical and Similarly-named Engineering Programs

Lead Society(ies):
○ *Badan Kerjasama Teknik Mesin Seluruh Indonesia* (BKSTM) – Indonesian Association of Higher Education in Mechanical Engineering
○ *Badan Kejuruan Mesin Persatuan Insinyur Indonesia* (BKM PII) – PII Chapter for Mechanical Engineers

These Discipline Criteria apply to all engineering programs that include “mechanical” or similar modifiers in their titles.

Curriculum

The curriculum must require students to apply basic sciences, mathematics (including multivariate calculus and differential equations) and principles of engineering sciences; to model, analyze, design, and apply physical systems, components or processes; and prepare students to work professionally in either thermal or mechanical systems.

Faculty

Faculty members teaching courses on design should have either certification of professional engineer or qualification through experience in engineering design and practices.

Discipline Criteria for Nuclear and Similarly-named Engineering Programs

Lead Society(ies):
○ *Himpunan Masyarakat Nuklir Indonesia* (HIMNI) – Indonesian Association for Nuclear Society

These Discipline Criteria apply to engineering program that include “nuclear”, “radiological”, “radiation”, or similar modifiers in their titles.

Curriculum

The curriculum shall provide strong fundamentals on advanced mathematics, science, engineering science and engineering design related to the objectives of the program. The curriculum must include the application of atomic and nuclear physics, and the transport of radiation and its interaction with matter, for nuclear power generation, medical, industrial, and agricultural areas; to perform nuclear engineering design; to measure nuclear and radiation processes. The program shall ensure that the curriculum must comply with international and national nuclear regulations by emphasizing the requirements for nuclear safety, non-destructive inspection, security and safeguards.

Faculty

The program must demonstrate that faculty members are qualified to teach nuclear engineering courses by education, equivalent design experience or board certification of a professional engineer depending on the program needs.

Discipline Criteria for Ocean and Similarly-named Engineering Programs

Lead Society(ies):
○ *Himpunan Ahli Pengelola Pesisir Indonesia* (HAPPI) – Indonesian Association of Experts in Coastal Management
○ *Himpunan Ahli Teknik Hidraulik Indonesia* (HATHI) – Indonesian Association of Experts in Hydraulics Engineering

These Discipline Criteria apply to engineering programs that include “coastal”, “ocean”, “marine”, “naval architecture”, or similar modifiers in their titles.

Curriculum

The curriculum must prepare graduates to have the knowledge and the skills to apply the principles of fluid and solid mechanics, dynamics, hydrostatics, hydrodynamics, probability and applied statistics, oceanography, and water waves, to engineering problems and to work in groups to perform engineering design at the system level, integrating multiple technical areas and addressing design optimization.

Faculty

Program faculty must have responsibility and sufficient authority to define, revised, implement, and achieve the program objectives

Discipline Criteria for General Engineering Programs

Lead Society(ies):
○ *Persatuan Insinyur Indonesia (PII)* – The Institute of Engineers Indonesia

These criteria is applicable only for programs having no available Discipline Criteria and wish to be evaluated solely by the Common Criteria.

Curriculum

No additional requirement beyond those required by the Common Criteria

Faculty

No additional requirement beyond those required by the Common Criteria