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Criteria for Accrediting Engineering Programs

Effective for Reviews during the 2019 Accreditation Cycle

PLEASE NOTE

(1) SEGMENTS IN BOLD REFLECT REVISIONS APPROVED BY THE ICACIT BOARD FOR THE 2018 REVIEW CYCLE

DEFINITIONS

While ICACIT recognizes and supports the prerogative of institutions to adopt and use the terminology of their choice, it is necessary for ICACIT volunteers and staff to have a consistent understanding of terminology. With that purpose in mind, the Committees will use the following basic definitions:

[1] Program Educational Objectives – Program educational objectives are broad statements that describe what graduates are expected to attain within a few years of graduation. Program educational objectives are based on the needs of the program’s constituencies.

[2] Constituencies - Faculty, students, graduates, employees, advisory committee and others consider the program.

[3] Student Outcomes – Student outcomes describe what students are expected to know and be able to do by the time of graduation. These relate to the knowledge, skills, and behaviors that students acquire as they progress through the program.

[4] Complex Engineering Problems – are those that cannot be resolved without in-depth engineering fundamentals and specialized engineering knowledge, including research literature of the discipline and one or more of the following characteristics:

  o Are high level problems including many component parts or sub-problems;
  o Involve infrequently encountered issues;

and its solution has one or more of the following characteristics:

  o Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models;
  o Are outside problems encompassed by standards and codes of practice for professional engineering;
  o Involve wide-ranging or conflicting technical, engineering and other issues;
  o Involve diverse groups of stakeholders with widely varying needs.

[5] Diverse Team – Team whose members have different characteristics such as gender, age, nationality, ethnic group, culture, etc., and a different formation or experiences that can bring different perspectives.

[6] Assessment – Assessment is one or more processes that identify, collect, and prepare data to evaluate the attainment of student outcomes. Effective assessment uses relevant direct, indirect, quantitative and qualitative measures as appropriate to the outcome being measured. Appropriate sampling methods may be used as part of an assessment process.

[7] Evaluation – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment processes. Evaluation determines the extent to which student outcomes are being attained. Evaluation results in decisions and actions regarding program improvement.
[8] University Level Mathematics – consists of mathematics above the algebra and trigonometry level. These represent a solid foundation for engineering topics and should emphasize concepts and mathematical principles, as well as numerical analysis.

[9] Basic Sciences – Disciplines focused on knowledge or understanding of the fundamental aspects of natural phenomena. Basic sciences consist of chemistry, physics, and other natural sciences including life, earth, and space sciences.

[10] Engineering Sciences – Have their roots in mathematics and basic sciences but carry knowledge further toward the creative application necessary to resolve engineering problems and represent the basis of the specialized discipline knowledge. These may include topics such as solid mechanics, fluid mechanics, thermodynamics, electrical and electronic circuits, computer science (except programming topics), materials science, soil mechanics, aerodynamics, control systems, among others, depending on the discipline.

[11] Engineering design – It is a creative, iterative and decision-making process, in which the basic sciences, mathematics, and the engineering sciences are applied to seek for viable solutions to problems that does not necessarily have a single answer. This process includes conceptualizing ideas; identify and formulate problems; exhaustively apply various disciplines and technologies; create ideas; identify restrictions and find solutions to the problem under these restrictions; verify the results; demonstrate ideas with plans, arguments, equations or programs; communicate with others; collaborate with others (teamwork); and continually plan and implement as planned. It is expected that all these tasks will be carried out in a holistic manner. The restrictions cover issues of public health and safety, cultural, social, economic and environmental.

[12] General Education – are studies that provide an appreciation of those broader issues that allow engineers to practice professionally in society. These studies may include management, economics, law, history, finance or a foreign language.
GENERAL CRITERIA

These criteria are intended to assure quality and to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

Criterion 1. Students
Student performance must be evaluated. Student progress must be monitored to foster success in attaining student outcomes, thereby enabling graduates to attain program educational objectives. Students must be advised regarding curriculum, career development and job placement.

The program must have and enforce policies for (a) accepting both new and transfer students, (b) awarding appropriate academic credit for courses taken at other institutions, and (c) develop pre-professional practices. The program must have and enforce procedures to ensure and document that students who graduate meet all graduation requirements.

Criterion 2. Program Educational Objectives
The program must have published program educational objectives that are consistent with the mission of the institution, the needs of the program’s various constituencies, and these criteria. There must be a documented and effective process for the establishment and the periodic review of these program educational objectives, involving program constituencies. This review must be systematically utilized to ensure they remain consistent with the institutional mission, the program’s constituents’ needs, and these criteria.

Criterion 3. Student Outcomes
The program must have documented student outcomes that prepare graduates to attain the program educational objectives.

Student outcomes are outcomes (a) through (l) plus any additional outcomes that may be articulated by the program:

(a) Engineering knowledge: an ability to apply knowledge of mathematics, science, and engineering to the solution of complex engineering problems.

(b) Investigation: an ability to conduct investigations of complex problems using research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of information to provide valid conclusions

(c) Design and development of solutions: an ability to design solutions for complex engineering problems and design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, and sustainability

(d) Individual and team work: an ability to function effectively as an individual, and as a member or leader in diverse teams and in multi-disciplinary settings

(e) Problem analysis: an ability to identify, formulate, research literature and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences and engineering sciences

(f) Ethics: an ability to apply ethical principles and commit to professional ethics and responsibilities
and norms of engineering practice

(g) Communication: an ability to communicate effectively on complex engineering activities with
the engineering community and with the society at large, such as being able to comprehend and
write effective reports and design documentation, make effective presentations, and give and
receive clear instructions

(h) Environment and sustainability: an ability to understand and evaluate the sustainability and the
impact of solution of complex engineering problems in a global, economic, environmental, and
societal context

(i) Lifelong learning: a recognition of the need for, and an ability to engage in independent and life-
long learning in the broadest context of technological change

(j) Engineering and society: an ability to apply reasoning informed by contextual knowledge to
assess societal, health, safety, legal and cultural issues and the consequent responsibilities
relevant to professional engineering practice

(k) Modern tool usage: an ability to create, select and apply appropriate techniques, resources, and
modern engineering and IT tools, including prediction and modeling, to complex engineering
problems, with an understanding of the limitations

(l) Project Management: an ability to demonstrate knowledge and understanding of engineering
management principles and economic decision-making and apply it.

Criterion 4. Continuous Improvement

The program must regularly use appropriate, documented processes for assessing and evaluating the
extent to which the student outcomes are being attained. The results of these evaluations must be
systematically utilized as input for the continuous improvement of the program. Other available
information may also be used to assist in the continuous improvement of the program.

Criterion 5. Curriculum

The curriculum must ensure consistency with the outcomes and objectives of the program and
institution.

The curriculum must include:

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

(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering
design appropriate to the student's field of study.

(c) a general education component that complements the technical content of the curriculum and
is consistent with the program and institution objectives.

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 and
incorporating appropriate engineering standards and multiple realistic constraints.

Criterion 6. Faculty

The program must demonstrate that the faculty members are of sufficient number and have the
competencies to cover all of the curricular areas of the program. There must be sufficient faculty to:
(a) accommodate adequate levels of student-faculty interaction, (b) student advising and counseling,
(c) university service activities, and (d) interactions with industrial and professional practitioners, as
well as employers of students. The program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program and to develop and implement processes for the evaluation, assessment, and continuing improvement of the program, its educational objectives and outcomes. **The program must ensure the professional development of its faculty.** The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, current engineering practice, teaching effectiveness and experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and licensure as professional engineers.

**Criterion 7. Facilities**
Classrooms, offices, laboratories, and associated equipment must be adequate to support attainment of the student outcomes and to provide an atmosphere conducive to learning. Modern tools, equipment, computing resources, and laboratories appropriate to the program must be available, accessible, and systematically maintained and upgraded to enable students to attain the student outcomes and to support program needs. Students must be provided appropriate guidance regarding the use of the tools, equipment, computing resources, and laboratories available to the program.

The library services and the computing and **communication** infrastructure must be adequate to support the scholarly and professional activities of the students and faculty.

**Criterion 8. Institutional Support**
Institutional support and leadership **from top management** must be adequate to ensure the quality and continuity of the program. Resources including institutional services, financial support, and staff (both administrative and technical) provided to the program must be adequate to meet program needs. The resources available to the program must be sufficient to attract, retain, and provide for the continued professional development of a qualified faculty. The resources available to the program must be sufficient to acquire, maintain, and operate infrastructures, facilities, and equipment appropriate for the program, and to provide an environment in which student outcomes can be attained.

**Criterion 9. Research**
The program should regulate and ensure the quality of the research of its faculty members. These investigations must be consistent with the discipline of the program and the research policies of the institution.

The program must ensure the rigor, relevance and quality of the research work of its students to obtain the academic degree.

The program should promote the publication of the research works of its faculty members and the respective socialization of these within the institution.
PROGRAM CRITERIA

Each program must satisfy applicable Program Criteria (if any). Program Criteria provide the specificity needed for interpretation of the baccalaureate level criteria as applicable to a given discipline. Requirements stipulated in the Program Criteria are limited to the areas of curricular topics and faculty qualifications. If a program, by virtue of its title, becomes subject to two or more sets of Program Criteria, then that program must satisfy each set of Program Criteria; however, overlapping requirements need to be satisfied only once.

PROGRAM CRITERIA FOR AGRICULTURAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “agricultural,” “forest,” or similar modifiers in their titles.

1. Curriculum
   The curriculum must include mathematics through differential equations and biological and engineering sciences consistent with the program educational objectives. The curriculum must prepare graduates to apply engineering to agriculture, aquaculture, forestry, human, or natural resources.

2. 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.

PROGRAM CRITERIA FOR BIOLOGICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “biological,” “biological systems,” “food,” or similar modifiers in their titles with the exception of bioengineering and biomedical engineering programs.

1. Curriculum
   The curriculum must include mathematics through differential equations, a thorough grounding in chemistry and biology and a working knowledge of advanced biological sciences consistent with the program educational objectives. The curriculum must prepare graduates to apply engineering to biological systems.

2. 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.
PROGRAM CRITERIA FOR CHEMICAL, BIOCHEMICAL, BIOMOLECULAR, AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “chemical,” “biochemical,” and similar modifiers in their titles.

1. Curriculum
The curriculum must provide a thorough grounding in the basic sciences including chemistry, physics, and/or biology, with some content at an advanced level, 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, including the hazards associated with these processes.

PROGRAM CRITERIA FOR CIVIL AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs including "civil" and similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science, consistent with the program educational objectives; apply knowledge of four technical areas appropriate to civil engineering; conduct civil engineering experiments and analyze and interpret the resulting data; design a system, component, or process in more than one civil engineering context; explain basic concepts in management, business, public policy, and leadership; and explain the importance of professional licensure.

2. Faculty
The program must demonstrate that faculty teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience. The program must demonstrate that it is not critically dependent on one individual.
PROGRAM CRITERIA FOR ELECTRICAL AND ELECTRONIC
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “electrical”, “electronic”, or similar modifiers in their titles.

1. Curriculum
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, including applications appropriate to the program name; mathematics through differential and integral calculus; sciences (defined as biological, chemical, or physical science); and engineering topics (including computing science) necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components.

The curriculum must include advanced mathematics, such as differential equations, linear algebra, complex variables, and discrete mathematics.

PROGRAM CRITERIA FOR ENGINEERING MANAGEMENT
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs using “management” or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to understand the engineering relationships between the management tasks of planning, organization, leadership, control, and the human element in production, research, and service organizations; to understand and deal with the stochastic nature of management systems. The curriculum must also prepare graduates to integrate management systems into a series of different technological environments.

2. Faculty
The major professional competence of the faculty must be in engineering, and the faculty should be experienced in the management of engineering and/or technical activities.
PROGRAM CRITERIA FOR ENVIRONMENTAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs including "environmental", "sanitary," or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to apply knowledge of mathematics through differential equations, probability and statistics, calculus-based physics, chemistry (including stoichiometry, equilibrium, and kinetics), an earth science, a biological science, fluid mechanics. The curriculum must prepare graduates to formulate material and energy balances, and analyze the fate and transport of substances in and between air, water, and soil phases; 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); design environmental engineering systems that include considerations of risk, uncertainty, sustainability, life-cycle principles, and environmental impacts; and apply 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.

2. 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.
PROGRAM CRITERIA FOR GEOLOGICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include "geological" and similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to have:
(1) the ability to apply mathematics including differential equations, calculus-based physics, and chemistry, to geological engineering problems;
(2) proficiency in geological science topics that emphasize geologic processes and the identification of minerals and rocks;
(3) the ability to visualize and solve geological problems in three and four dimensions;
(4) proficiency in the engineering sciences including statics, properties/strength of materials, and geomechanics;
(5) the ability to apply principles of geology, elements of geophysics, geological and engineering field methods; and
(6) engineering knowledge to design solutions to geological engineering problems, which will include one or more of the following considerations: the distribution of physical and chemical properties of earth materials, including surface water, ground water (hydrogeology), and fluid hydrocarbons; the effects of surface and near-surface natural processes; the impacts of construction projects; the impacts of exploration, development, and extraction of natural resources, and consequent remediation; disposal of wastes; and other activities of society on these materials and processes, as appropriate to the program objectives.

2. Faculty
Evidence must be provided that the program’s faculty members understand professional engineering practice and maintain currency in their respective professional areas. The program’s faculty must have responsibility and authority to define, revise, implement, and achieve program objectives.

PROGRAM CRITERIA FOR INDUSTRIAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs using “industrial” or similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to design, develop, implement, and improve integrated systems that include people, materials, information, equipment and energy. The curriculum must include in-depth instruction to accomplish the integration of systems using appropriate analytical, computational, and experimental practices.

2. Faculty
Evidence must be provided that the program faculty understand professional practice and maintain currency in their respective professional areas. Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives.
PROGRAM CRITERIA FOR MARINE ENGINEERING,
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “naval architecture” and/or
“marine engineering” or similar modifiers in their titles.

1. Curriculum

The program must prepare graduates to apply probability and statistical methods to naval
architecture and marine engineering problems; to have basic knowledge of fluid mechanics,
dynamics, structural mechanics, materials properties, hydrostatics, and energy/propulsion systems
in the context of marine vehicles and; to have familiarity with instrumentation appropriate to naval
architecture and/or marine engineering.

2. Faculty

Program faculty must have sufficient curricular and administrative control to accomplish the program
objectives. Program faculty must have responsibility and sufficient authority to define, revise,
implement and achieve the program objectives.

PROGRAM CRITERIA FOR MECHANICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria will apply to all engineering programs that include "mechanical" or similar
modifiers in their titles.

1. Curriculum

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

2. Faculty

The program must demonstrate that faculty members responsible for the upper-level professional
program are maintaining currency in their specialty area.
PROGRAM CRITERIA FOR MATERIALS, METALLURGICAL,
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs including "materials," "metallurgical," and similar modifiers in their titles. All programs in the materials related areas share these criteria, including programs with materials, materials processing, ceramics, glass, polymer, metallurgical, and similar modifiers in their titles.

1. Curriculum
The curriculum must prepare graduates to apply advanced science (such as chemistry and physics) and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, 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 to solve materials selection and design problems, and; to utilize experimental, statistical, and computational methods consistent with the program educational objectives.

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

PROGRAM CRITERIA FOR MINING
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs including "mining" and similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics as applied to mining engineering problem applications; to have fundamental knowledge in the geological sciences including characterization of mineral deposits, physical geology, structural or engineering geology, and mineral and rock identification and properties; to be proficient in statics, dynamics, strength of materials, fluid mechanics, thermodynamics, and electrical circuits; to be proficient in engineering topics related to both surface and underground mining, including: mining methods, planning and design, ground control and rock mechanics, health and safety, environmental issues, and ventilation; to be proficient in additional engineering topics such as rock fragmentation, materials handling, mineral or coal processing, mine surveying, and valuation and resource/reserve estimation as appropriate to the program objectives. The laboratory experience must prepare graduates to be proficient in geologic concepts, rock mechanics, mine ventilation, and other topics appropriate to the program objectives.

2. Faculty
Evidence must be provided that the program faculty understand professional engineering practice and maintain currency in their respective professional areas. Program faculty must have responsibility and authority to define, revise, implement, and achieve program objectives.
PROGRAM CRITERIA FOR PETROLEUM
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include "petroleum," "natural gas," and similar modifiers in their titles.

1. Curriculum
The program must prepare graduates to be proficient in mathematics through differential equations, probability and statistics, fluid mechanics, strength of materials, and thermodynamics; design and analysis of well systems and procedures for drilling and completing wells; characterization and evaluation of subsurface geological formations and their resources using geoscientific and engineering methods; design and analysis of systems for producing, injecting, and handling fluids; application of reservoir engineering principles and practices for optimizing resource development and management; the use of project economics and resource valuation methods for design and decision making under conditions of risk and uncertainty.

PROGRAM CRITERIA FOR SOFTWARE
AND SIMILARLY NAMED ENGINEERING PROGRAMS

These program criteria apply to engineering programs that include “software” or similar modifiers in their titles.

1. Curriculum
The curriculum must provide both breadth and depth across the range of engineering and computer science topics implied by the title and objectives of the program.

The curriculum must prepare graduates to analyze, design, verify, validate, implement, apply, and maintain software systems; to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer science and supporting disciplines to complex software systems; to work in one or more significant application domains; and to manage the development of software systems.
PROPOSED CHANGES TO ACCREDITATION CRITERIA

The following section presents proposed changes to the accreditation criteria for engineering programs as approved by the ICACIT Board of Directors at its meeting on August 28, 2018 for a review and comment period that expires on March 1, 2019. The ICACIT Board of Directors will determine, based on the comments received and the proposals of the Engineering Accreditation Committee (CAI), the changes that are introduced in the accreditation criteria. These changes will be approved by the ICACIT Board of Directors in the first half of 2019 and will come into effect for the 2020 Accreditation Cycle.

These changes in accreditation criteria are based on the International Engineering Alliance (www.ieagreements.org) graduate attributes, the best practices in accreditation among the Washington Accord signatories, and the contributions of ICACIT General Assembly, Advisory Board and volunteers.

Comments related to the proposed changes must be sent in writing to the address: Av Del Pinar 152. Oficce 707. Santiago de Surco. Lima 033. Peru, or by email to acreditacion@icacit.org.pe

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Criterion 9. Research
The program must ensure the quality of research works and promote the development and publication of research works coherent with the discipline.

The program must have faculty who develop research or innovation, in coherence with the research lines of the program.

Research projects generate new information and subsequent knowledge (a) within the discipline or (b) about the way in which it is taught.