

CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS

Effective for Reviews During the
2016-2017 Accreditation Cycle

Incorporates all changes
approved by the
ABET
Board of Delegates
Engineering Area Delegation
as of
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Engineering Accreditation Commission

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TABLE OF CONTENTS

GENERAL CRITERIA FOR BACCALAUREATE LEVEL PROGRAMS	2
Students	3
Program Educational Objectives	3
Student Outcomes	3
Continuous Improvement	4
Curriculum	4
Faculty	4
Facilities	5
Institutional Support	5
GENERAL CRITERIA FOR MASTER'S LEVEL PROGRAMS	5
PROGRAM CRITERIA	8
Aerospace Engineering	8
Agricultural Engineering	8
Architectural Engineering	9
Bioengineering and Biomedical Engineering	10
Biological Engineering	10
Chemical, Biochemical, Biomolecular Engineering	11
Civil Engineering	11
Construction Engineering	12
Electrical, Computer, Communication(s), and Telecommunication(s) Engineering	12
Engineering, General Engineering, Engineering Physics, and Engineering Science	13
Engineering Management	14
Engineering Mechanics	14
Environmental Engineering	15
Fire Protection Engineering	15
Geological Engineering	16
Industrial Engineering	17
Manufacturing Engineering	17
Materials, Metallurgical, and Ceramics Engineering	18
Mechanical Engineering	18
Mining Engineering	19
Naval Architecture and Marine Engineering	19
Nuclear and Radiological Engineering	20
Ocean Engineering	20
Optics and Photonic	21
Petroleum Engineering	21
Software Engineering	22
Surveying Engineering	22
Systems Engineering	23
PROPOSED CHANGES TO THE CRITERIA	24

Criteria for Accrediting Engineering Programs

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Definitions

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

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.

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 skills, knowledge, and behaviors that students acquire as they progress through the program.

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.

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.

This document contains three sections:

The first section includes important **definitions** used by all ABET commissions.

The second section contains the **General Criteria for Baccalaureate Level Programs** that must be satisfied by all programs accredited by the Engineering Accreditation Commission of ABET and the **General Criteria for Masters Level Programs** that must be satisfied by those programs seeking advanced level accreditation.

The third section contains the **Program Criteria** that must be satisfied by certain programs. The applicable Program Criteria are determined by the technical specialties indicated by the title of the program. Overlapping requirements need to be satisfied only once.

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.

I. GENERAL CRITERIA FOR BACCALAUREATE LEVEL PROGRAMS

All programs seeking accreditation from the Engineering Accreditation Commission of ABET must demonstrate that they satisfy all of the following General Criteria for Baccalaureate Level Programs.

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 and career matters.

The program must have and enforce policies for accepting both new and transfer students, awarding appropriate academic credit for courses taken at other institutions, and awarding appropriate academic credit for work in lieu of courses taken at the institution. 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, systematically utilized, and effective process, involving program constituencies, for the periodic review of these program educational objectives that ensures 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 (k) plus any additional outcomes that may be articulated by the program.

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability
- (d) an ability to function on multidisciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

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 requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:

- (a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.
- (b) one and one-half years 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 practice 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 (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.
- (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.

One year is the lesser of 32 semester hours (or equivalent) or one-fourth of the total credits required for graduation.

Criterion 6. Faculty

The program must demonstrate that the faculty members are of sufficient number and they have the competencies to cover all of the curricular areas of the program. There must be sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional

development, and 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. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, 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 information infrastructure must be adequate to support the scholarly and professional activities of the students and faculty.

Criterion 8. Institutional Support

Institutional support and leadership 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.

II. GENERAL CRITERIA FOR MASTER'S LEVEL AND INTEGRATED BACCALAUREATE-MASTER'S LEVEL ENGINEERING PROGRAMS

Programs seeking accreditation at the master's level from the Engineering Accreditation Commission of ABET must demonstrate that they satisfy the following criteria, including all of the aspects relevant to integrated baccalaureate-master's programs or stand-alone master's programs, as appropriate.

Criteria Applicable to Integrated Baccalaureate-Master's Level Engineering Programs

Engineering programs that offer integrated baccalaureate-master's programs must meet all of the General Criteria for Baccalaureate Level Programs and the Program Criteria applicable to the program name, regardless of whether students in these programs receive both baccalaureate and master's degrees or only master's degrees during their programs of study. In addition, these programs must meet all of the following criteria. If any students are admitted into the master's portion of the combined program without having completed the integrated baccalaureate portion, they must meet the criteria given below.

Criteria Applicable to all Engineering Programs Awarding Degrees at the Master's Level

Students and Curriculum

The master's program must have and enforce procedures for verifying that each student has completed a set of post-secondary educational and professional experiences that:

- a) Supports the attainment of student outcomes of Criterion 3 of the general criteria for baccalaureate level engineering programs, and
- b) Includes at least one year of math and basic science (basic science includes the biological, chemical, and physical sciences), as well as at least one-and-one-half years of engineering topics and a major design experience that meets the requirements of Criterion 5 of the general criteria for baccalaureate level engineering programs.

If the student has graduated from an EAC of ABET accredited baccalaureate program, the presumption is that items (a) and (b) above have been satisfied.

The master's level engineering program must have and enforce policies and procedures ensuring that a program of study with specific educational goals is developed for each student. Student performance and progress toward completion of their programs of study must be monitored and evaluated. The program must have and enforce procedures to ensure and document that students who graduate meet all graduation requirements.

The master's level engineering program must require each student to demonstrate a mastery of a specific field of study or area of professional practice consistent with the master's program name and at a level beyond the minimum requirements of baccalaureate level programs.

The master's level engineering program of study must require the completion of at least 30 semester hours (or equivalent) beyond the baccalaureate program.

Each student's overall program of post-secondary study must satisfy the curricular components of the baccalaureate level program criteria relevant to the master's level program name.

Program Quality

The master's level engineering program must have a documented and operational process for assessing, maintaining and enhancing the quality of the program.

Faculty

The master's level engineering program must demonstrate that the faculty members are of sufficient number and that they have the competencies to cover all of the curricular areas of the program. Faculty teaching graduate level courses must have appropriate educational qualifications by education or experience. The program must have sufficient faculty to accommodate adequate levels of student-faculty interaction, student advising and counseling, university service activities, professional development, and interactions with industrial and professional practitioners, as well as employers of students.

The master's level engineering program faculty must have appropriate qualifications and must have and demonstrate sufficient authority to ensure the proper guidance of the program. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching effectiveness and experience, ability to communicate, level of scholarship, participation in professional societies, and licensure.

Facilities

Means of communication with students, and student access to laboratory and other facilities, must be adequate to support student success in the program, and to provide an atmosphere conducive to learning. These resources and facilities must be representative of current professional practice in the discipline. Students must have access to appropriate training regarding the use of the resources available to them.

The library and information services, computing and laboratory infrastructure, and equipment and supplies must be available and adequate to support the education of the students and the scholarly and professional activities of the faculty.

Remote or virtual access to laboratories and other resources may be employed in place of physical access when such access enables accomplishment of the program's educational activities.

Institutional Support

Institutional support and leadership 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 infrastructure, facilities, and equipment appropriate for the program, and to provide an environment in which student learning outcomes can be attained.

III. PROGRAM CRITERIA

Each program must satisfy applicable Program Criteria (if any). Program Criteria provide the specificity needed for interpretation of the general 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
AEROSPACE
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Institute of Aeronautics and Astronautics

These program criteria apply to engineering programs that include "aerospace," "aeronautical," "astronautical," or similar modifiers in their titles.

1. Curriculum

Aeronautical engineering programs must prepare graduates to have a knowledge of aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control. Astronautical engineering programs must prepare graduates to have a knowledge of orbital mechanics, space environment, attitude determination and control, telecommunications, space structures, and rocket propulsion. Aerospace engineering programs or other engineering programs combining aeronautical engineering and astronautical engineering, must prepare graduates to have knowledge covering one of the areas -- aeronautical engineering or astronautical engineering as described above -- and, in addition, knowledge of some topics from the area not emphasized. Programs must also prepare graduates to have design competence that includes integration of aeronautical or astronautical topics.

2. Faculty

Program faculty must have responsibility and sufficient authority to define, revise, implement, and achieve program objectives. The program must demonstrate that faculty teaching upper-division courses have an understanding of current professional practice in the aerospace industry.

PROGRAM CRITERIA FOR
AGRICULTURAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Agricultural and Biological Engineers

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
ARCHITECTURAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: American Society of Civil Engineers

Cooperating Society: American Society of Heating, Refrigerating, and Air-Conditioning
Engineers

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

1. Curriculum

The program must demonstrate that graduates can apply mathematics through differential equations, calculus-based physics, and chemistry. The four basic architectural engineering curriculum areas are building structures, building mechanical systems, building electrical systems, and construction/construction management. Graduates are expected to reach the synthesis (design) level in one of these areas, the application level in a second area, and the comprehension level in the remaining two areas. The engineering topics required by the general criteria shall support the engineering fundamentals of each of these four areas at the specified level. Graduates are expected to discuss the basic concepts of architecture in a context of architectural design and history.

The design level must be in a context that:

- a. Considers the systems or processes from other architectural engineering curricular areas,
- b. Works within the overall architectural design,
- c. Includes communication and collaboration with other design or construction team members,
- d. Includes computer-based technology and considers applicable codes and standards, and
- e. Considers fundamental attributes of building performance and sustainability.

2. Faculty

The program must demonstrate that faculty teaching courses that are primarily engineering design in content are qualified to teach the subject matter by virtue of

professional licensure, or by education and design experience. It must also demonstrate that the majority of the faculty members teaching architectural design courses are qualified to teach the subject matter by virtue of professional licensure, or by education and design experience.

PROGRAM CRITERIA FOR
BIOENGINEERING, BIOMEDICAL,
AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Biomedical Engineering Society

Cooperating Societies: American Ceramic Society, American Institute of Chemical Engineers,

American Society of Agricultural and Biological Engineers,

American Society of Mechanical Engineers, and

Institute of Electrical and Electronics Engineers

These program criteria apply to engineering programs that include "bioengineering," "biomedical," or similar modifiers in their titles.

1. Curriculum

The structure of the curriculum must provide both breadth and depth across the range of engineering and science topics consistent with the program educational objectives and student outcomes. The curriculum must prepare graduates with experience in:

- Applying principles of engineering, biology, human physiology, chemistry, calculus-based physics, mathematics (through differential equations) and statistics;
- Solving bio/biomedical engineering problems, including those associated with the interaction between living and non-living systems;
- Analyzing, modeling, designing, and realizing bio/biomedical engineering devices, systems, components, or processes; and
- Making measurements on and interpreting data from living systems.

PROGRAM CRITERIA FOR
BIOLOGICAL

AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: American Society of Agricultural and Biological Engineers

Cooperating Societies: American Academy of Environmental Engineers and Scientists, American Ceramic Society,

American Institute of Chemical Engineers, American Society of Civil Engineers,

American Society of Mechanical Engineers, Biomedical Engineering Society,

CSAB, Institute of Electrical and Electronics Engineers,

Institute of Industrial Engineers, and Minerals, Metals, and Materials Society

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
Lead Society: American Institute of Chemical Engineers

These program criteria apply to engineering programs that include "chemical," "biochemical," "biomolecular," or 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
Lead Society: American Society of Civil Engineers

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

1. Curriculum

The curriculum must prepare graduates to apply knowledge of mathematics through differential equations, calculus-based physics, chemistry, and at least one additional area of basic science; apply probability and statistics to address uncertainty; analyze and solve problems in at least four technical areas appropriate to civil engineering; conduct experiments in at least two technical areas of civil engineering and analyze and interpret the resulting data; design a system, component, or process in at least two civil engineering contexts; include principles of sustainability in design; explain basic

concepts in project management, business, public policy, and leadership; analyze issues in professional ethics; 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
CONSTRUCTION
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Civil Engineers

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

1. Curriculum

The program must prepare graduates to apply knowledge of mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus-based physics; to analyze and design construction processes and systems in a construction engineering specialty field, applying knowledge of methods, materials, equipment, planning, scheduling, safety, and cost analysis; to explain basic legal and ethical concepts and the importance of professional engineering licensure in the construction industry; to explain basic concepts of management topics such as economics, business, accounting, communications, leadership, decision and optimization methods, engineering economics, engineering management, and cost control.

2. Faculty

The program must demonstrate that the majority of 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 faculty must include at least one member who has had full-time experience and decision-making responsibilities in the construction industry.

PROGRAM CRITERIA FOR
ELECTRICAL, COMPUTER, COMMUNICATIONS, TELECOMMUNICATION(S)
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Institute of Electrical and Electronics Engineers
Cooperating Society for Computer Engineering Programs: CSAB

These program criteria apply to engineering programs that include "electrical," "electronic(s)," "computer," "communication(s)," telecommunication(s), 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 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, complex variables, and discrete mathematics.

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 theory and systems.

The curriculum for programs containing the modifier “telecommunication(s)” must include design and operation of telecommunication networks for services such as voice, data, image, and video transport.

PROGRAM CRITERIA FOR
ENGINEERING, GENERAL ENGINEERING,
ENGINEERING PHYSICS, ENGINEERING SCIENCE,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society for Engineering Education

These program criteria apply to engineering programs that include “engineering (without modifiers),” “general engineering,” “engineering physics,” or “engineering science(s),” in their titles.

There are no program-specific criteria beyond the General Criteria.

PROGRAM CRITERIA FOR
ENGINEERING MANAGEMENT
AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Institute of Industrial Engineers

Cooperating Societies: American Institute of Chemical Engineers, American Society of Civil Engineers, American Society of Mechanical Engineers, Institute of Electrical and Electronics Engineers,
Society of Manufacturing Engineers, and Society of Petroleum Engineers

These program criteria apply to engineering programs that include “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
ENGINEERING MECHANICS
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Mechanical Engineers

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

1. Curriculum

The program curriculum must require students to use mathematical and computational techniques to analyze, model, and design physical systems consisting of solid and fluid components under steady state and transient conditions.

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
ENVIRONMENTAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Academy of Environmental Engineers and Scientists
Cooperating Societies: American Institute of Chemical Engineers,
American Society of Agricultural and Biological Engineers, American Society of Civil
Engineers,
American Society of Heating, Refrigerating and Air-Conditioning Engineers,
American Society of Mechanical Engineers, SAE International,
and Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "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, and 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
FIRE PROTECTION
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Fire Protection Engineers

These program criteria apply to engineering programs that include "fire protection" or similar modifiers in their title.

1. Curriculum

The program must prepare graduates to have proficiency in the application of science and engineering to protect the health, safety, and welfare of the public from the impacts

of fire. This includes the ability to apply and incorporate an understanding of the fire dynamics that affect the life safety of occupants and emergency responders and the protection of property; the hazards associated with processes and building designs; the design of fire protection products, systems, and equipment; the human response and behavior in fire emergencies; and the prevention, control, and extinguishment of fire.

2. Faculty

The program must demonstrate that faculty members maintain currency in fire protection engineering practice.

PROGRAM CRITERIA FOR
GEOLOGICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "geological" or 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
Lead Society: Institute of Industrial Engineers

These program criteria apply to engineering programs that include "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
MANUFACTURING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Manufacturing Engineers

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

1. Curriculum

The program must prepare graduates to have proficiency in (a) materials and manufacturing processes: ability to design manufacturing processes that result in products that meet specific material and other requirements; (b) process, assembly and product engineering: ability to design products and the equipment, tooling, and environment necessary for their manufacture; (c) manufacturing competitiveness: ability to create competitive advantage through manufacturing planning, strategy, quality, and control; (d) manufacturing systems design: ability to analyze, synthesize, and control manufacturing operations using statistical methods; and (e) manufacturing laboratory or facility experience: ability to measure manufacturing process variables and develop technical inferences about the process.

2. Faculty

The program must demonstrate that faculty members maintain currency in manufacturing engineering practice.

PROGRAM CRITERIA FOR
MATERIALS (1), METALLURGICAL (2), CERAMICS (3)
AND SIMILARLY NAMED ENGINEERING PROGRAMS

- (1,2) Lead Society for Materials and Metallurgical Engineering Programs: The Minerals, Metals & Materials Society
- (3) Lead Society for Ceramics Engineering Programs: American Ceramic Society
- (1) Cooperating Societies for Materials Engineering Programs: American Ceramic Society, American Institute of Chemical Engineers, and American Society of Mechanical Engineers
- (2) Cooperating Society for Metallurgical Engineering Programs: Society for Mining, Metallurgy, and Exploration
- (3) Cooperating Society for Ceramics Engineering Programs: The Minerals, Metals & Materials Society

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

1. 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.

2. Faculty

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

PROGRAM CRITERIA FOR
MECHANICAL
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Society of Mechanical Engineers

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 topics 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
MINING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society for Mining, Metallurgy, and Exploration

These program criteria apply to engineering programs that include "mining" or 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
NAVAL ARCHITECTURE, MARINE ENGINEERING,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Naval Architects and Marine Engineers

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
NUCLEAR, RADIOLOGICAL,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: American Nuclear Society

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

1. Curriculum

The program must prepare the students to apply advanced mathematics, science, and engineering science, including atomic and nuclear physics, and the transport and interaction of radiation with matter, to nuclear and radiological systems and processes; to perform nuclear engineering design; to measure nuclear and radiation processes; to work professionally in one or more of the nuclear or radiological fields of specialization identified by the program.

2. Faculty

The program must demonstrate that faculty members primarily committed to the program have current knowledge of nuclear or radiological engineering by education or experience.

PROGRAM CRITERIA FOR
OCEAN
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: Society of Naval Architects and Marine Engineers
Cooperating Societies: American Society of Civil Engineers
and Institute of Electrical and Electronics Engineers

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

1. Curriculum

The curriculum must prepare graduates to have the knowledge and the skills to apply the principles of fluid and solid mechanics, dynamics, hydrostatics, probability and applied statistics, oceanography, water waves, and underwater acoustics to engineering

problems and to work in groups to perform engineering design at the system level, integrating multiple technical areas and addressing design optimization.

2. Faculty

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

PROGRAM CRITERIA FOR OPTICAL, PHOTONIC, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Co-Lead Societies: SPIE, the International Society for Optical Engineering
or Institute of Electrical and Electronic Engineers

These program criteria apply to all engineering programs that include "optical," "photonic," 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 prepare students to have knowledge of and appropriate laboratory experience in: geometrical optics, physical optics, optical materials, and optical and/or photonic devices and systems.

The curriculum must prepare students to apply principles of engineering, basic sciences, mathematics (such as multivariable calculus, differential equations, linear algebra, complex variables, and probability and statistics) to modeling, analyzing, designing, and realizing optical and/or photonic devices and systems.

2. Faculty

Faculty members who teach courses with significant design content must be qualified by virtue of design experience as well as subject matter knowledge.

PROGRAM CRITERIA FOR PETROLEUM AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Society of Petroleum Engineers

These program criteria apply to engineering programs that include "petroleum," "natural gas," or 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

Lead Society: CSAB

Cooperating Society: Institute of Electrical and Electronics Engineers

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 include computing fundamentals, software design and construction, requirements analysis, security, verification, and validation; software engineering processes and tools appropriate for the development of complex software systems; and discrete mathematics, probability, and statistics, with applications appropriate to software engineering.

2. Faculty

The program must demonstrate that faculty members teaching core software engineering topics have an understanding of professional practice in software engineering and maintain currency in their areas of professional or scholarly specialization.

PROGRAM CRITERIA FOR
SURVEYING
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Lead Society: National Society for Professional Surveyors
Cooperating Society: American Society of Civil Engineers

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

1. Curriculum

The curriculum must prepare graduates to work competently in one or more of the following areas: boundary and/or land surveying, geographic and/or land information systems, photogrammetry, mapping, geodesy, remote sensing, and other related areas.

2. Faculty

Programs must demonstrate that faculty members teaching courses that are primarily design in content are qualified to teach the subject matter by virtue of professional licensure or by educational and design experience.

PROGRAM CRITERIA FOR
SYSTEMS
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Co-Lead Societies: American Society of Mechanical Engineers, CSAB,
Institute of Electrical and Electronics Engineers, Institute of Industrial Engineers,
ISA, International Council on Systems Engineering, or
SAE International

These program criteria apply to engineering programs that include “systems (without other modifiers)” in their title.

There are no program- specific criteria beyond the General Criteria.

PROPOSED CHANGES TO THE CRITERIA

The following section presents proposed changes to these criteria as approved by the ABET Board of Delegates and the Engineering Area Delegation on October 16/17, 2015, for a one-year first reading review and comment period. Comments will be considered until June 15, 2016. The ABET Board of Delegates and the Engineering Area Delegation will determine, based on the comments received and on the advice of the EAC, the content of the adopted criteria. The adopted criteria will then become effective following the ABET Board of Delegates and the Engineering Area Delegation Meetings in the fall of 2016 and will first be applied by the EAC for accreditation reviews during the 2017-18 academic year.

Comments relative to the proposed criteria changes should be addressed to: Director for Accreditation Operations, ABET, 415 N. Charles Street, Baltimore, MD 21201 or to accreditation@abet.org.

**PROPOSED REVISIONS
TO
CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS
DEFINITIONS,
GENERAL CRITERION 3 STUDENT OUTCOMES,
AND
GENERAL CRITERION 5 CURRICULUM**

Background

Graduates of programs accredited by the EAC must be prepared for professional practice of engineering, and engineering is evolving to meet continually emerging demands. Criterion 3, Student Outcomes, as published in *Criteria for Accrediting Engineering Programs* was written 20 years ago in preparation for outcomes-based education. Over a period of several years, the EAC Criteria Committee has been engaged in a review of Criterion 3 and has sought input from a broad variety of sources concerning skills and attributes needed for the professional practice of engineering. Based on the input received, the EAC has developed this proposed revision to the *Criteria for Accrediting Engineering Programs*. Revisions are proposed to Criterion 3, framing student outcomes that address relevant topic areas and moving some items into Criterion 5, Curriculum. Definitions and explanations currently placed in Criterion 5 were moved to a revised introductory section to the *Criteria for Accrediting Engineering Programs* after the harmonized ABET definitions and before *Section I. General Criteria for Baccalaureate Level Programs*.

Based on feedback received and the recommendation of the EAC, the Engineering Area Delegation may decide to extend the review and comment period for one additional year. Likewise, due to the breadth and complexity of the proposed changes and the impact to programs demonstrating compliance with Criteria, a phase-in implementation period may be recommended by the EAC to the Engineering Area Delegation.

Criteria for Accrediting Engineering Programs
Effective for Reviews during the 20XX-20YY Accreditation Cycle

Definitions

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

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.

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 skills, knowledge, and behaviors that students acquire as they progress through the program.

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.

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.

This document contains three sections:

The first section includes important **definitions** used by all ABET commissions.

The second section contains the **General Criteria for Baccalaureate Level Programs** that must be satisfied by all programs accredited by the Engineering Accreditation Commission of ABET and the **General Criteria for Masters Level Programs** that must be satisfied by those programs seeking advanced level accreditation.

The third section contains the **Program Criteria** that must be satisfied by certain programs. The applicable Program Criteria are determined by the technical specialties indicated by the title of the program. Overlapping requirements need to be satisfied only once.

~~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.~~

These criteria are intended to provide a framework of education that prepares graduates to enter the professional practice of engineering who are (i) able to participate in diverse multicultural workplaces; (ii) knowledgeable in topics relevant to their discipline, such as usability, constructability, manufacturability and sustainability; and (iii) cognizant of the global dimensions, risks, uncertainties, and other implications of their engineering solutions. Further, these criteria are intended to assure quality 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.

The Engineering Accreditation Commission of ABET recognizes that its constituents may consider certain terms to have certain meanings; however, it is necessary for the Engineering Accreditation Commission to have consistent terminology. Thus, the Engineering Accreditation Commission will use the following definitions:

Basic Science – Basic sciences consist of chemistry and physics, and other biological, chemical, and physical sciences, including astronomy, biology, climatology, ecology, geology, meteorology, and oceanography.

College-level Mathematics – College-level mathematics consists of mathematics above pre-calculus level.

Engineering Science – Engineering sciences are based on mathematics and basic sciences but carry knowledge further toward creative application needed to solve engineering problems.

Engineering Design – Engineering design is the process of devising a system, component, or process to meet desired needs, specifications, codes, and standards within constraints such as health and safety, cost, ethics, policy, sustainability, constructability, and manufacturability. It is an iterative, creative, decision-making process in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally into solutions.

Teams – A team consists of more than one person working toward a common goal and may include individuals of diverse backgrounds, skills, and perspectives.

One Academic Year – One academic year is the lesser of 32 semester credits (or equivalent) or one-fourth of the total credits required for graduation with a baccalaureate degree.

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 (k) plus any additional outcomes that may be articulated by the program.~~

~~(a) an ability to apply knowledge of mathematics, science, and engineering~~

~~(b) an ability to design and conduct experiments, as well as to analyze and interpret data~~

~~(c) an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability~~

~~(d) an ability to function on multidisciplinary teams~~

~~(e) an ability to identify, formulate, and solve engineering problems~~

- ~~(f) an understanding of professional and ethical responsibility~~
- ~~(g) an ability to communicate effectively~~
- ~~(h) the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context~~
- ~~(i) a recognition of the need for, and an ability to engage in life-long learning~~
- ~~(j) a knowledge of contemporary issues~~

- ~~(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.~~

The program must have documented student outcomes. Attainment of these outcomes prepares graduates to enter the professional practice of engineering.

Student outcomes are outcomes (1) through (7) plus any additional outcomes that may be articulated by the program.

1. An ability to identify, formulate, and solve engineering problems by applying principles of engineering, science, and mathematics.
2. An ability to apply both analysis and synthesis in the engineering design process, resulting in designs that meet desired needs.
3. An ability to develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
4. An ability to communicate effectively with a range of audiences.
5. An ability to recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
6. An ability to recognize the ongoing need for additional knowledge and locate, evaluate, integrate, and apply this knowledge appropriately.
7. An ability to function effectively on teams that establish goals, plan tasks, meet deadlines, and analyze risk and uncertainty.

Criterion 5. Curriculum

~~The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The faculty must ensure that the program curriculum devotes adequate attention and time to each component, consistent with the outcomes and objectives of the program and institution. The professional component must include:~~

~~(a) one year of a combination of college level mathematics and basic sciences (some with experimental experience) appropriate to the discipline. Basic sciences are defined as biological, chemical, and physical sciences.~~

~~(b) one and one-half years 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 practice 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 (often iterative), in which the basic sciences, mathematics, and the engineering sciences are applied to convert resources optimally to meet these stated needs.~~

~~(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.~~

~~One year is the lesser of 32 semester hours (or equivalent) or one fourth of the total credits required for graduation.~~

The curriculum requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The curriculum must support attainment of the student outcomes and must include:

(a) one academic year of a combination of college-level mathematics and basic sciences (some with experimental experience) appropriate to the program.

(b) one and one-half academic years of engineering topics, consisting of engineering sciences and engineering design appropriate to the program and utilizing modern engineering tools.

(c) a broad education component that includes humanities and social sciences, complements the technical content of the curriculum, and is consistent with the program educational objectives.

Students must be prepared to enter the professional practice of engineering 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 constraints.