Engineering Accreditation Commission

CRITERIA FOR ACCREDITING

ENGINEERING PROGRAMS

Effective for Reviews During the 2018 - 2019 Accreditation Cycle Incorporates all changes approved by the ABET Board of Delegates Engineering Area Delegation as of October 20, 2017

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Criteria for Accrediting Engineering Programs Effective for Reviews during the 201 8-2019 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 termino logy. With that purpose in mind, the Commissions will use the following basic definitions:

- <u>Program Educational Objectives</u> Program educational objectives are broad statements that describe what graduates are expected to attain within a few years after graduation. Program educational objectives are based on the needs of the program's constituencies.
- <u>Student Outcomes</u> 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.
- <u>Assessment</u> 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.
- <u>Evaluation</u> 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 be5 (pr)3 dqua2 (c)v1 (r)3 ssms onnplirrtt s oecrsios

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 2018-

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 gradua tion.

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 accommodat e 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 facu lty 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 schola

operate infrastructures, facilities, and equipment appropriate for the program, an d to

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 o r 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 fa culty 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 representati ve 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,

PROGRAM CRITERIA FOR AEROSPACE AND SIMILARLY NAMED ENGINEERING PROGRAMS Lead Society : American Institute of Aeronautics and Astronautics

These program criteria a pply 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, s tructures, 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 structu res, 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 ast ronautical engineering as described aboveeas --

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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 syst ems, 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 ov.9 (q)-s47 0 Td ()T002 Tw -9.12s47 0 Td ()n le1 (eerg8t)-5 (4 (m)-2 (a)-4l)-4 (

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 E lectrical 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:

- (a) Applying principles of engineering, biology, human physiology, chemistry, calculus -based physics, mathematics (through differential equations) and statistics;
- (b) Solving bio/biomedical engineering problems, including those associated with the interaction between living and non- living systems;
- (c) Analyzing, modeling, designing, and rea lizing bio/biomedical engineering devices, systems, components, or processes; and
- (d) 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 ng 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 e quations, 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, BIOC HEMICAL, 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 t o 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 context s; 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 pr ogram 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 a nalysis; 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 subjec t 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 mat hematics.

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

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

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 Gen eral Criteria.

PROGRAM CRITERIA FOR ENGINEERING MANAGEMENT AND SIMILARLY NAMED ENGINEERING PROGRAMS

Lead Society: Institute of Industrial Engineers

Cooperating Societies: American Institute of Chemical Engineers, America n 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 in clude "management" or similar modifiers in their titles.

1. Curriculum

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 an d 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 modificer in their titles.

1. Curriculum

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PROGRAM CRITERIA FOR FIRE PROTECTION AND SIMILARLY NAMED ENGINEERING PRO GRAMS 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, contr ol, 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 PRO GRAMS 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 rock s;
- 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
- 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 e

PROGRAM CRITERIA FOR INDUSTRIAL

PROGRAM CRITERIA FOR MANUFACTURING AND SIMILARLY NAMED ENGINEERING PROGRAMS Lead Society: Society of Manufacturing E ngineers

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 manufact ure; (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 sta tistical 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 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, desig n, 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 cu rrency 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 Architect s 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 stat istical 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 h ave 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 responsi bility 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 N uclear 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 profes sionally 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.

2018-2019 Criteria for Accrediting E

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 progra m 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 SYSTEMS AND SIMILARLY NAMED ENGINEERING PROGRAMS

Co- Lead Societies: American Society of Mechanical Engineers, CSAB,

Institute of Electrical and Electron ics Engineers, Institute of Industrial Engineers,

IV. PROPOSED CHANGES TO THE CRITERIA

Proposed changes to certain sections of the Criteria for Accrediting Engineering Programs are approved by the ABET Engineering Area Delegation as of October 20, 2017, for implementation in the 2019–2020 accreditation review cycle.

The changed sections are:

- The Introduction and Definitions that apply to all parts of the criteria
- The General Criteria for Accrediting Baccalaureate Level Programs
 - Criterion 3, Student Outcomes
 - Criterion 5, Curriculum

Text for the changed sections is provided below. Programs scheduled for a general review in the 2018 – 2019 should not begin transitioning to the newly approved criteria. Programs scheduled for a general review in the 2019 - 2020 cycle and beyond may begin to transition as soon as possible.

Criteria for Accrediting Engineering Programs for implementation in the 2019 - 2020 accreditation cycle

Introduction

These criteria apply to all accredited engineering programs. Furthermore, these criteria are intended to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of its 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.

Definitions The Engineering Complex Engineering Problems - Complex engineering problems include

welfare, as well as global, cultural, social, environmental, and economic factors

3. an ability to communicate effectively

The following section presents proposed program criteria as approved by the ABET Engineering Area Delegation on October 20, 2017, for a review and comment period. Comments will be considered until June 15, 2018. The ABET Engineering Area Delegation will determine, based on the comments received and on the advice of the EAC, the content of the adopted criteria. The criteria would only become effective if approved at the ABET Engineering Area Delegation meeting in the fall of 2018 and the earliest possible application would be for accreditation reviews during the 2019-20 academic year.

PROGRAM CRITERIA FOR CYBERSECURITY ENGINEERING AND ENGINEERING PROGRAMS THAT INCLUDE "SECURITY," "CYBERSECURITY," "COMPUTER SECURITY," "CYBER OPERATIONS," "INFORMATION ASSURANCE," "INFORMATION SECURITY," OR SIMILAR MODIFIERS IN THEIR TITLES Co- Lead Societies: Institute of Electrical and Electronics Engineers, CSAB, International Council on Systems Engineering (INCOSE)

These program criteria apply to engineering programs that include "security", "cybersecurity", "computer security", "cyber operations", "information assurance", "information security", or similar modifiers in their titles.

1. Curriculum

Comments relative to the proposed criteria should be submitted by the link for comments available here and on the ACCREDITATION ALERTS section of the ABET website.

LINK: COMMENT: Proposed Program C riteria for Cybersecurity Engineering