CRITERIA FOR ACCREDITING ENGINEERING PROGRAMS

Effective for Evaluations During the
2000-2001 Accreditation Cycle

Incorporates all changes
approved by the
ABET
Board of Directors
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Engineering Accreditation Commission

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IMPORTANT NOTICE

This document contains two sets of criteria for accrediting engineering programs, one identified as *Conventional Criteria* and one identified as *Engineering Criteria 2000*.

For general comprehensive reviews occurring during the three years of 1998-99 through 2000-01, institutions may elect to have their programs evaluated under either the Conventional Criteria or Engineering Criteria 2000. When an institution elects to be evaluated under a particular set of criteria, all programs will be reviewed under that particular set of criteria. For general comprehensive reviews occurring during 2001-02 and thereafter, all reviews will be conducted under Engineering Criteria 2000.

CONVENTIONAL CRITERIA

Criteria for Accrediting Engineering Programs

Effective for Evaluations during the 2000-2001 Accreditation Cycle

I. GENERAL CRITERIA

I.A. Program Design and Level

In order to be considered for accreditation, engineering programs must be designed to prepare graduates for the practice of engineering at a professional level. Programs designed to prepare graduates for supporting roles in engineering (e.g., engineering technology) are not eligible, nor are programs which do not provide an adequate base for the application of fundamental concepts to the practice of engineering. To assist in the identification and recognition of characteristics of engineering programs for accreditation purposes, the criteria that follow have been adopted by ABET.

I.B. Intent of Criteria

I.B.1. General criteria are intended to assure an adequate foundation in science, the humanities and the social sciences, engineering sciences, and engineering design methods, as well as preparation in a higher engineering specialization appropriate to the challenge presented by today's complex and difficult problems. They are intended to afford sufficient flexibility in science requirements so that programs requiring special backgrounds, such as in the life or earth sciences, can be accommodated. They are designed to be flexible enough to permit the expression of an institution's individual qualities and ideals. They are to be regarded as a statement of principles to be applied with judgment in each case rather than as rigid and arbitrary standards. Finally, they are intended to encourage and stimulate and not to restrain creative and imaginative programs. In any case in which EAC of ABET is convinced that well-considered experimentation in engineering educational programs is under way, it shall give sympathetic consideration to departures from the criteria.

I.B.2. Program criteria relative to the accreditation of engineering programs in particular disciplines are developed by the cognizant Participating Bodies of ABET or, at the request of EAC of ABET, by other societies or groups having appropriate expertise. The program criteria provide the specificity needed for interpretation of the general criteria as applicable to a given discipline. Program criteria must be accepted by the EAC and ABET before they can have effect in the accreditation process. When approved, program criteria are published as an integral part of this document, following the general criteria. A program in a curricular area covered by approved program criteria must be in compliance with both the general criteria and the program criteria in order to be accredited. Provisions of the program criteria may be more restrictive than related provisions of the general criteria.

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, understanding that overlapping requirements need to be satisfied only once. However, the general criteria are emphatic that there must be sufficient faculty and resources to assure that program objectives are met. These programs must have faculty and resources sufficient to meet the additional curricular objectives implied by the expanded title.

I.C. <u>General Basic-Level Criteria</u>

I.C.1. Faculty

This section of the criteria relates to the size and competence of the faculty, the standards and quality of instruction in the engineering departments and in the scientific and other operating departments in which engineering students receive instruction, and evidence of concern about improving the effectiveness of pedagogical techniques.

I.C.1.a. The heart of any educational program is the faculty. All other matters are secondary to a competent, qualified, and forward-looking faculty that can give an overall scholarly atmosphere to the operation and provide an appropriate role model for engineering students.

I.C.1.b. The overall competence of the faculty may be judged by such factors as the level of academic training of its members; the diversity of their backgrounds; their non-academic engineering experience; their experience in teaching; their ability to communicate fluently in English; their interest in and enthusiasm for developing more effective teaching methods; their level of scholarship as shown by scientific and professional publications; their registration as Professional Engineers; their degree of participation in professional, scientific and other learned societies; their participation in professional development programs; recognition by students of their professional acumen; and their personal interest in the students' curricular and extracurricular activities.

I.C.1.c. A program at the basic level must have no fewer than three-full-time faculty members (i.e., the fractions of time devoted to the basic-level program by each faculty member must add to at least three.) This statement shall not be interpreted to preclude the accreditation of programs offered primarily by part-time faculty members. The institution must demonstrate that effective mechanisms are in place to assure adequate levels of student-faculty interaction, student advising, and faculty concern for and control over the curriculum, as would be expected in programs offered primarily by full-time faculty members. If the faculty has additional obligations, such as graduate teaching and/or research, additional faculty members must be present to ensure that at least three full-time-equivalent faculty members are devoted to each basic-level program. Under no circumstances should a program be critically dependent on one individual.

I.C.1.d. Stability, continuity, and morale of the faculty are important to inspire confidence and respect in students and to ensure that their education will be consistently and effectively directed throughout their programs. High turnover rates and signs of serious divisions or lack of communication among faculty members are considered weaknesses in the program.

I.C.1.e. *Teaching loads* must be consistent with the stated program objectives and expectations for research and professional development. Engineering faculty members, regardless of their individual capabilities, cannot function effectively either as teachers or seekers of new understanding if they are too heavily burdened with classroom assignments. Stimulation of student minds presupposes continuing professional growth of the faculty through study of new developments in areas of technology and science and in areas of instructional innovation.

I.C.1.f. The engineering faculty must assume the responsibility of assuring that the students receive proper *curricular and career advising.* Those individuals responsible for and involved in advising must know and understand ABET criteria for accrediting engineering programs.

I.C.2. Curricular Objective

Engineering is that profession in which knowledge of the mathematical and natural sciences gained by study, experience, and practice is applied with judgment to develop ways to utilize, economically, the materials and forces of nature for the benefit of mankind. A significant measure of an engineering education is the degree to which it has prepared the graduate to pursue a productive engineering career that is characterized by continued professional growth.

This section of the criteria relates to the extent to which a program develops the ability to apply pertinent *knowledge to the practice of engineering in an effective and professional manner.*

Included are the development of: (1) a capability to delineate and solve in a practical way the problems of society that are susceptible to engineering treatment, (2) a sensitivity to the socially-related technical problems which confront the profession, (3) an understanding of the ethical characteristics of the engineering profession and practice, (4) an understanding of the engineer's responsibility to protect both occupational and public health and safety, and (5) an ability to maintain professional competence through life-long learning. These objectives are normally met by a curriculum in which there is a progression in the course work and in which fundamental scientific and other training of the earlier years is applied in later engineering courses.

Institutions are expected to develop and articulate clearly program goals that are in keeping with the overall institutional goals, the student body served, and any other constraints that affect the program. In addition, they are expected to demonstrate success in meeting these goals.

I.C.3. Curricular Content

Course work which meets the ABET engineering criteria may be accomplished in fewer academic years than are normally required by an institution for completion of a degree program. Although additional time is thus available in an accreditable engineering program for the implementation of individual educational objectives of students or their institutions, additional course work in engineering or related areas beyond that specifically required by ABET will be needed to fulfill the objective of preparing the graduate adequately to enter the engineering profession. The program must not only meet the specified minimum content but must also show evidence of being an integrated experience aimed at preparing the graduate to function as an engineer. The institution must address these needs and objectives in developing the program and its content. The institution should consider also the quality of its educational programs and assure sufficient individual attention to each student by the faculty. Section enrollments appropriate to class objectives and accessibility of faculty to students are considerations appropriate to the assessment of educational quality. Admission requirements should be established both to strengthen the quantitative approach to engineering and to support the development of the social and humanistic aspects of the engineering student's education.

*In the statements that follow, one-half year of study can, at the option of the institution, be considered to be equivalent to 16 semester credit hours (24 quarter hours).**

[*For a program of 128 semester hours (192 quarter hours), one-half year of study equals exactly 16 semester hours (24 quarter hours). For a program requiring more than 128 semester hours or 192 quarter hours, 16 semester hours or 24 quarter hours may be considered to constitute one-half year of study in any of the curricular components specified by these criteria. For a program requiring fewer total credit hours, one-half year of study is considered to be one-eighth of the total program. Programs using measurements other than semester or quarter credit hours will be evaluated on a reasonably comparable basis to the above.]

I.C.3.a. For those institutions which elect to prepare graduates for entry into the profession at the basic level, ABET expects the curricular content of the program to include the equivalent of at least three years of study in the areas of mathematics, basic sciences, humanities and social sciences, and engineering topics. The course work must include at least:

I.C.3.a.(1) one year of an appropriate combination of mathematics and basic sciences,

I.C.3.a.(2) one-half year of humanities and social sciences, and

I.C.3.a.(3) one and one-half years of engineering topics.

I.C.3.b. The overall curriculum must provide an integrated educational experience directed toward the development of the ability to apply pertinent knowledge to the identification and solution of practical problems in the designated area of engineering specialization. The curriculum must be designed to provide, and student transcripts must reflect, a sequential development leading to advanced work and must include both analytical and experimental studies. The objective of integration may be met by courses specifically designed for that purpose, but it is recognized that a variety of other methods may be effective.

Some of the requirements in a particular curricular area may be met through elective courses. However, it is incumbent upon the institution to publish in its catalog or printed advisement guide directions for choosing electives that will assure that ABET engineering criteria are met by all students.

I.C.3.c. The classification of a course into one or more of the curricular areas depends on the course content rather than the course title or the name of the offering department. A course may be classified as being partially in one curricular area while the remainder of it is in another.

I.C.3.d. While ABET favors a flexible approach to the design of curricular content, it also recognizes the need for specific coverage in each curricular area. These are:

I.C.3.d.(1) Mathematics and Basic Sciences

I.C.3.d.(1)(a) Studies in mathematics must be beyond trigonometry and must emphasize mathematical concepts and principles rather than computation. These studies must include differential and integral calculus and differential equations. Additional work is encouraged in one or more of the subjects of probability and statistics, linear algebra, numerical analysis, and advanced calculus.

I.C.3.d.(1)(b) The objective of the studies in basic sciences is to acquire fundamental knowledge about nature and its phenomena, including quantitative expression. These studies must include both general chemistry and calculus-based general physics at appropriate levels, with at least a two-semester (or equivalent) sequence of study in either area. Also, additional work in life sciences, earth sciences, and or advanced chemistry or physics may be utilized to satisfy the basic sciences requirement, as appropriate for various engineering disciplines.

I.C.3.d.(1)(c) Course work devoted to developing skills in the use of computers or computer programming may not be used to satisfy the mathematics/basic sciences requirement.

I.C.3.d.(2) Humanities and Social Sciences

I.C.3.d.(2)(a) Studies in the humanities and social sciences serve not only to meet the objectives of a broad education but also to meet the objectives of the engineering profession. Therefore, studies in the humanities and social sciences must be planned to reflect a rationale or fulfill an objective appropriate to the engineering profession and the institution's educational objectives. In the interests of making engineers fully aware of their social responsibilities and better able to consider related factors in the decision-making process, institutions must require course work in the humanities and social sciences as an integral part of the engineering program. This philosophy cannot be overemphasized. To satisfy this requirement, the courses selected must provide both breadth and depth and not be limited to a selection of unrelated introductory courses.

I.C.3.d.(2)(b) Such course work must meet the generally accepted definitions that humanities are the branches of knowledge concerned with man and his culture, while social sciences are the studies of individual relationships in and to society. Examples of traditional subjects in these areas are philosophy, religions, history, literature, fine arts, sociology, psychology, political science, anthropology, economics, and foreign languages other than English or a student's native language. Nontraditional subjects are exemplified by courses such as technology and human affairs, history of technology, and professional ethics and social responsibility. Courses that instill cultural values are acceptable, while routine exercises of personal craft are not. Consequently, courses that involve performance must be accompanied by theory or history of the subject.

I.C.3.d.(2)(c) Subjects such as accounting, industrial management, finance, personnel administration, engineering economy, and military training may be appropriately included either as required or elective courses in engineering curricula to satisfy desired program objectives of the institution. However, such courses usually do not fulfill the objectives desired of the humanities and social sciences content.

I.C.3.d.(3) Engineering Topics

I.C.3.d.(3)(a) Engineering topics include subjects in the engineering sciences and engineering design.

I.C.3.d.(3)(b) 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. Such subjects include mechanics, thermodynamics, electrical and electronic circuits, materials science, transport phenomena, and computer science (other than computer programming skills), along with other subjects depending upon the discipline. While it is recognized that some subject areas may be taught from the standpoint of either the basic sciences or engineering sciences, the ultimate determination of the engineering science content is based upon the extent to which there is extension of knowledge toward creative application. In order to promote breadth, the curriculum must include at least one engineering course outside the major disciplinary area.

I.C.3.d.(3)(c) 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 and mathematics and engineering sciences are applied to convert resources optimally to meet a stated objective. Among the fundamental elements of the design process are the establishment of objectives and criteria, synthesis, analysis, construction, testing, and evaluation. The engineering design component of a curriculum must include most of the following features: development of student creativity, use of open-ended problems, development and use of modern design theory and methodology, formulation of design problem statements and specifications, consideration of alternative solutions, feasibility considerations, production processes, concurrent engineering design, and detailed system descriptions. Further, it is essential to include a variety of realistic constraints, such as economic factors, safety, reliability, aesthetics, ethics, and social impact.

I.C.3.d.(3)(d) Each educational program must include a meaningful, major engineering design experience that builds upon the fundamental concepts of mathematics, basic sciences, the humanities and social sciences, engineering topics, and communication skills. The scope of the design experience within a program should match the requirements of practice within that discipline. The major design experience should be taught in section sizes that are small enough to allow interaction between teacher and student. This does not imply that all design work must be done in isolation by individual students; team efforts are encouraged where appropriate. Design cannot be taught in one course; it is an experience that must grow with the student's development. A meaningful, major design experience means that, at some point when the student's academic development is nearly complete, there should be a design experience that both focuses the student's attention on professional practice and is drawn from past course work. Inevitably, this means a course, or a project, or a thesis that focuses upon design. "Meaningful" implies that the design experience is significant within the student's major and that it draws upon previous course work, but not necessarily upon every course taken by the student.

I.C.3.d.(3)(e) The public, from catalog statements and other advising documents, and ABET, from the self-study questionnaire, should be able to discern the goals of a program and the logic of the selection of the engineering topics in the program. In particular, the institution must describe how the design experience is developed and integrated throughout the curriculum, show that it is consistent with the objectives of the program as required by section I.C.2. above, and identify the major, meaningful design experiences in the curriculum.

I.C.3.d.(3)(f) Course work devoted to developing drafting skills may not be used to satisfy the engineering design requirement.

I.C.3.e. Other courses, which are not predominantly mathematics, basic sciences, the humanities and social sciences, or engineering topics, may be considered by the institution as essential to some engineering programs. Portions of such courses may include subject matter that can be properly classified in one of the essential curricular areas, but this must be demonstrated in each case.

I.C.3.f. Appropriate laboratory experience which serves to combine elements of theory and practice must be an integral component of every engineering program. Every student in the program must develop a competence to conduct experimental work such as that expected of engineers in the discipline represented by the program. It is also necessary that each student have "hands-on" laboratory experience, particularly at the upper levels of the program. Instruction in safety procedures must be an integral component of students' laboratory experiences. ABET expects some course work in the basic sciences to include or be complemented with laboratory work.

I.C.3.g. Appropriate computer-based experience must be included in the program of each student. Students must demonstrate knowledge of the application and use of digital computation techniques for specific engineering problems. The program should include, for example, the use of computers for technical calculations, problem solving, data acquisition and processing, process control, computer-assisted design, computer graphics, and other functions and applications appropriate to the engineering discipline. Access to computational facilities must be sufficient to permit students and faculty to integrate computer work into course work whenever appropriate throughout the academic program.

I.C.3.h. Students must demonstrate knowledge of the application of probability and statistics to engineering problems.

I.C.3.i. Competence in written communication in the English language is essential for the engineering graduate. Although specific course work requirements serve as a foundation for such competence, the development and enhancement of writing skills must be demonstrated through student work in engineering work and other courses. Oral communication skills in the English language must also be demonstrated within the curriculum by each engineering student.

I.C.3.j. An understanding of the ethical, social, economic, and safety considerations in engineering practice is essential for a successful engineering career. Course work may be provided for this purpose, but as a minimum it should be the responsibility of the engineering faculty to infuse professional concepts into all engineering course work.

I.C.4. Student Body

This section of the criteria relates to the admission, retention, and scholastic work of students and the records of graduates both in further academic study and in professional practice.

I.C.4.a. An important consideration in the evaluation of an engineering program is the quality and performance of the students and graduates. When students are carefully selected either at the time of admission or by appropriate retention standards, the level and pace of instruction can be high.

I.C.4.b. In view of the increasing number of students who take their initial college-level work at institutions other than the degree-granting schools having programs accredited by EAC of ABET, it is appropriate for the degree-granting institutions to establish policies for the acceptance of transfer students and for the validation of credit for courses taken elsewhere. The institution must have in place procedures to assure that the programs of all transfer students satisfy all applicable ABET general and program criteria.

I.C.4.c. Sources of information on the quality of student work include examples of examinations, homework problems, laboratory exercises, designs, and reports. These items, which include the competence of students in both subject matter areas and communication skills, must be made available to the visiting team.

I.C.4.d. The record that graduates are making in the profession or in further academic study in other institutions is a factor to be considered in accrediting. An institution applying for accreditation of a program should be prepared, if possible, to produce records of graduates over a period of at least three years.

I.C.5. Administration

This section of the criteria relates to the attitude and policy of the administration of the engineering division toward teaching, research, and scholarly production, and the quality of leadership at all levels of administration of the division.

I.C.5.a. A capable faculty can perform its functions best in an atmosphere of good relations with the administration. This requires good communication between faculty members and administrators, and a mutual concern with policies that affect the faculty.

I.C.5.b. The college administration should have four basic roles: selection, supervision, and support of the faculty; selection and supervision of the students; operation of the facilities for the benefit of the faculty and students; and interpretation of the college to members of the profession and to the public. In performing many of these functions, the administrators should not operate alone, but should seek advice from individual faculty members, faculty committees, and special consultants.

I.C.5.c. Constructive leadership by the dean of the college and by the heads or chairs of the departments is important. Characteristics of successful administrators often include engineering background and scholarly attainments, participation in the affairs of engineering organizations, positive interest in the educational process, cooperation with other administrators, and willingness to assume the responsibilities of the position.

I.C.6. Institutional Facilities

I.C.6.a. An engineering program must be supported by adequate physical facilities, including office and classroom space, laboratories, and shop facilities suitable for the scope of the program's activities.

I.C.6.b. The libraries in support of the engineering unit must be both technical and non-technical, to include books, journals, and other reference material for collateral reading in connection with the instructional and research programs and professional work. The library collection should reflect the existence of an active acquisition policy; this policy should include specific acquisitions on the request and recommendation of the faculty of the engineering unit. While the library collections should be reasonably complete and should go well beyond the minimum collection required for use by students in specialized programs, there should be in existence such arrangements as are necessary for computer-accessible information centers and inter-library loan services for both books and journals. The library collections, whether centralized or decentralized, should be readily available for use with the assistance of a trained library staff, or through an open-stack arrangement, or both. The ultimate test of the library is the use made of it by the students and faculty. Use of the library depends on many factors including opening and closing hours, reading room space, availability and helpfulness of the staff, and accessibility of material.

I.C.6.c. The computer facilities available to the engineering students and faculty must be adequate to encourage the use of computers as a part of the engineering educational experience. These facilities must be appropriate for engineering applications such as engineering computation, modeling and simulation, computer-assisted design, and laboratory applications. Students and faculty should have ready access to computational facilities. These facilities should have reasonable turnaround and response time and a competent support staff. The ultimate test of the computer facilities is the use made of them by the students and the faculty.

I.C.6.d. The laboratory facilities must reflect the requirements of the offered educational program. The laboratories must be equipped with instruments and equipment of kind and quality to ensure the effective functioning of the laboratory. Each curriculum must have a carefully constructed and functioning plan for the continued replacement, modernization, maintenance, and support of laboratory equipment and related facilities. This plan is an essential part of these criteria and must be carefully presented, monitored, and implemented.

I.C.7. Institutional Commitment

This section of the criteria relates to the commitment of the institution, both financially and philosophically, to the program in engineering. This commitment may be evidenced by the relationship of the engineering unit to the institution as a whole, by the fiscal policy toward and the financial resources available to the engineering unit, and by the suitability of facilities including laboratories, libraries, and computer facilities.

I.C.7.a. The organizational structure of a university should be designed to bring together and to correlate its resources effectively. ABET is specifically interested in the general status of the engineering unit and its programs in the institution, and in the overall administration as it relates to the engineering unit and the achievement of its educational objectives.

I.C.7.b. A sound fiscal policy must ensure the provision of sufficient funds for the acquisition, retention, and continued professional development of a well-qualified faculty; the acquisition, maintenance, and operation of office and laboratory facilities, equipment, and instrumentation; the creation and maintenance of a library, both technical and nontechnical; and the creation, maintenance, and operation of computer facilities appropriate to the needs and requirements of the engineering unit.

I.C.7.c. The institution must provide facilities adequate for the support of the engineering programs offered, as defined in section I.C.6.a.

I.D. Cooperative Education Criteria

I.D.1. Identification - The requirements which must be fulfilled by students who enter and complete the cooperative education program should be identified in an official publication of the institution.

I.D.2. Requirements - In addition to meeting the general criteria for engineering programs, a cooperative education program must include the following requirements.

I.D.2.a. Admission of students to co-op programs must be the responsibility of the educational institution.

I.D.2.b. Formalized alternation of periods of full-time academic college training with periods of full-time work experience of approximately equal length.

I.D.2.c. At least one calendar year of institution-supervised work experiences in several industrial periods.

I.D.2.d. Enrollment by the student in the co-op program during the periods of employment. Evidence of cooperative education participation, progress, and employer evaluation of the student must be maintained as a matter of permanent institutional record.

I.D.2.e. Productive academic relationship between the faculty of the college and the co-op program administrators.

I.D.2.f. Efforts must be made to ensure that work assignments are related to academic and career goals, and that progressively more responsible positions are realized in the work experience periods.

I.D.2.g. Students must be informed of the evaluation of their work experience.

I.D.3. Employer Commitment - There should be evidence of marked commitment on the part of the institution and the participating employers of the program. The cooperative work experience period should be more than incidental employment—it should be part of an industry training activity, recognized as an acceptable part of a professional employee development program.

I.E. General Advanced Level Criteria

General advanced level criteria are established to encourage the development of new, innovative, and/or experimental advanced level engineering programs. The range of programs for which EAC of ABET will consider advanced level accreditation includes, but is not limited to, programs that, when compared to the basic level, provide additional depth in a student's primary engineering discipline; provide additional breadth in engineering areas related to the primary discipline; provide a deeper immersion in cultural, social, and/or business studies related to engineering practice; emphasize broad study in manufacturing, construction, engineering management, and/or engineering entrepreneurship; and that are offered jointly by the engineering unit and another academic unit that result in one or more degrees with the title "engineering."

I.E.1. Faculty - Advanced level criteria for faculty are the same as those for the basic level (section I.C.1.) with the following exception: In a program that involves an additional year of study and relies on entering students having already completed a basic-level program, three full-time-equivalent faculty members must be primarily committed to the program. All other programs submitted for advanced level accreditation must have no fewer than four full-time-equivalent faculty members whose primary commitments are to that program.

I.E.2. Curricular Objective (Amplifies basic-level criteria section I.C.2.)

I.E.2.a. The institution must clearly specify the educational objectives of the advanced level program in terms of the desired competencies to be developed by the program's graduates.

I.E.2.b. The institution must define programs of study that students must follow to meet the educational objectives (e.g., defined curriculum, projects, laboratories, equipment, etc.).

I.E.2.c. The program must have a well-developed process for assessing the extent to which the educational objectives are being achieved by the graduates (e.g., grading system, videotapes of students' oral defenses of theses, reviews of experimental techniques, critiques of written communication skills, measures of project comprehensiveness, etc.).

I.E.2.d. There must be reasonable institution-established criteria and standards of performance that must be met by the students for them to qualify as meeting the educational objectives (e.g., a specified grade level in course work, significant project or research, content and quality of reports or theses, performance in oral defense, etc.).

I.E.3. Curricular Content (Replaces basic-level criteria section I.C.3.)

I.E.3.a. The advanced level program must ensure that each graduate has satisfied (at the institution being evaluated or another) all of the general basic-level curricular content criteria and at least one of the sets of basic-level program curricular content criteria (including nontraditional).

I.E.3.b. The program must include the equivalent of at least one year of study beyond that specified in criteria section I.E.3.a. above. This additional year must consist primarily of subject material at an advanced level not normally associated with a basic-level program.

I.E.3.c. The program must include an engineering project or engineering research activity (experimental or analytical) of significant depth requiring innovation and creativity and resulting in a thesis or report that demonstrates both mastery of the subject matter and a high level of written communication skills.

I.E.4. Student Body - Advanced level criteria for the student body are the same as those for the basic level (criteria section I.C.4.).

I.E.5. Administration - Advanced level criteria for the administration are the same as those for the basic level (criteria section I.C.5.).

I.E.6. Institutional Facilities - Advanced level criteria for institutional facilities are the same as those for the basic level (criteria section I.C.6.).

I.E.7. Institutional Commitment - Advanced level criteria for institutional commitment are the same as those for the basic-level (criteria section I.C.7.).

II. PROGRAM CRITERIA

II.A. PROGRAM CRITERIA FOR AEROSPACE AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Institute of Aeronautics and Astronautics, Inc.

II.A.1. Applicability

These program criteria apply to engineering programs which include “aerospace,” “aeronautical,” “astronautical,” and similar modifiers in their titles.

II.A.2. Curriculum

II.A.2.a. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

All aeronautical engineering programs must include topics in aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control.

All astronautical engineering programs must include topics in orbital mechanics, space environment, attitude determination and control, telecommunications, space structures, and rocket propulsion.

Aerospace engineering programs or other programs combining aeronautical engineering and astronautical engineering may emphasize either area by satisfying the criteria for that area and including some topics from the area not emphasized.

II.A.2.b. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

There must be at least one conceptual or preliminary design course that integrates pertinent technical areas through the use of trade-off studies. These studies shall highlight the compromises necessary to meet a stated design objective. The remainder of the design requirement can be fulfilled by those portions of other courses that can be designated as design. In order to satisfy the quality and integration objectives which are paramount in engineering design, approximately one-half year of engineering design is expected.

II.A.3. Administration (Amplifies criteria section I.C.5.)

AIAA favors a separate faculty for aerospace engineering with a chair or head equal in status to the chair or head of other engineering or science departments. It has been demonstrated that strong aerospace engineering programs can also flourish either as joint programs in a multidisciplinary department or as options under other engineering disciplines. If such should be the case, the aerospace engineering program must have an identifiable faculty with sufficient curricular and administrative control to accomplish appropriate program objectives.

II.B. PROGRAM CRITERIA FOR AGRICULTURAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Agricultural Engineers

II.B.1. Applicability

These program criteria apply to engineering programs which include “agricultural” and similar modifiers in their titles. They also apply to agriculturally-based programs in biological, food, and forest engineering.

II.B.2. Faculty

II.B.2.a. Size of Faculty. (Amplifies criteria section I.C.1.b.)

An agricultural engineering program must be supported by a minimum of five faculty members, or as an alternative, three full-time-equivalent teaching faculty members.

II.B.2.b. Faculty Qualifications. (Amplifies criteria section I.C.1.b.)

Faculty members who teach basic agricultural engineering courses must have engineering degrees and those teaching design should be registered or preparing themselves for registration.

II.B.3. Curriculum

II.B.3.a. Curriculum Objectives and Content (Amplifies criteria section I.C.2. and 3.)

The agricultural engineering curriculum must emphasize the application of engineering and the basic and applied sciences to agriculture and the food system; the biological engineering curriculum must emphasize the application of engineering and the basic sciences to biological processes and systems; the food engineering curriculum must emphasize the application of engineering and the basic sciences to processing, preservation, packaging, and transportation of food products; the forest engineering curriculum must emphasize the application of engineering and the basic sciences, including forestry, to resource management, regenerating, growing, harvesting, transportation, and processing of forest products.

Emphasis shall be placed on the engineering relationships between plants, animals, and related natural resources and humans. Included are machines, processes, and energy for the production and processing of food, feed, fiber, biomass, forest, and other biologically based products.

II.B.3.b. Basic and Engineering Sciences. (Amplifies criteria sections I.C.3.d.(1)(b) and (3)(b))

A curriculum in agricultural engineering or forest engineering must include instruction in biological sciences and/or natural resource sciences.

A curriculum in biological engineering or food engineering must include inorganic and organic chemistry plus one-half year of biological science courses. A portion of the biological science courses may be used to satisfy the basic science requirement, as needed. Up to one-fourth of an academic year of the biological science courses (such as: food science, soil science, microbiology, animal science, plant science, etc.) may be counted toward the engineering science requirements, provided that such a biological science course is taught as an application of science that qualifies it as engineering science.

II.B.3.c. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

Designing systems and machines for agricultural and biological applications requires the integration of biological sciences in the design process. A significant portion of the courses in the engineering topics must include open-ended design problems.

II.B.3.d. Administration and Institutional Commitment (Amplifies criteria sections I.C.5. and I.C.7.)

When the agricultural engineering program is administered outside a college or school of engineering, there must be demonstrated evidence that the guidance of the program is under the management of a qualified agricultural engineering faculty and that budgetary support, curricular development, and instruction are equivalent to those ordinarily found in an engineering department of a college or school of engineering.

II.C. PROGRAM CRITERIA FOR ARCHITECTURAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Civil Engineers, Inc.
(Lead Society in Cooperation with The American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc.)

II.C.1. Applicability

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

II.C.2. Faculty

II.C.2.a. Faculty Size (Amplifies criteria section I.C.1.c.)

The minimum number of full-time faculty members must be four (4). Their major responsibilities shall be teaching in the architectural engineering program.

II.C.2.b. Faculty Qualifications (Amplifies criteria section I.C.1.b.)

The majority of the full-time engineering members of the faculty should be registered Professional Engineers. A majority of those faculty teaching courses which are primarily engineering design in content must be registered Professional Engineers. A majority of those faculty teaching courses which are primarily architectural design in content must be either registered Professional Engineers or Registered Architects.

II.C.2.c. Teaching Loads (Amplifies criteria section I.C.1.d.)

A full-time faculty workload must reflect other appropriate activities, e.g. research, advising, institutional and committee service, and professional society responsibilities. The evaluation of the teaching load should reflect class size, modality of instruction, cost instructional support, and contact hours.

II.C.2.d. Faculty Participation (Amplifies criteria sections I.C.1. and I.C.2.)

Faculty members shall be involved with the professional development of students, providing students with the opportunity to interact with practitioners in their major fields of interest. Such opportunities could be provided through a student organization, or equivalent experience, that has the demonstrated support of the academic unit administering the program.

II.C.3. Curriculum

II.C.3.a. Objective and Content (Amplifies criteria sections I.C.2. and I.C.3.)

To achieve a broad base of coverage, the curriculum structure must provide coverage in at least two of the three areas of structures, environmental systems, and construction/construction management.

II.C.3.b. Engineering Science (Amplifies criteria section I.C.3.d.(3)(b))

Engineering Science must include statics, strength of materials, thermodynamics, fluid mechanics, electric circuits, and engineering economics.

II.C.3.c. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

A minimum of one-half year is required in engineering design. The program is encouraged to develop innovative means of integrating design concepts and methodology throughout the curriculum, which must culminate in a major comprehensive design experience. Since the architectural engineering design process generally involves a team approach, team design projects are highly recommended. The final design experience should include practitioner involvement whenever appropriate and possible. Student reports and presentations should be an integral part of the final design experience.

II.C.3.d. Humanities and Social Sciences (Amplifies criteria section I.C.3.d.(2))

At least one course in architectural history must be included.

II.C.3.e. Other courses (Amplifies criteria section I.C.3.e.)

In addition to engineering design, at least six semester hours or the equivalent in architectural design must be included. Graduates must have a demonstrated ability to communicate graphically.

II.C.3.f. Student body (Amplifies criteria section I.C.4.b.)

For a design course to be acceptable for transfer credit, its content must have been reviewed by a faculty member of the program.

II.D. PROGRAM CRITERIA FOR BIOENGINEERING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Institute of Electrical and Electronics Engineers, Inc.
(Lead Society in cooperation with the American Institute of Chemical Engineers, the American Society of Agricultural Engineers, the American Society of Mechanical Engineers, and the National Institute of Ceramic Engineers)

II.D.1. Applicability

These program criteria apply to bioengineering programs and others which include "biomedical" and similar modifiers in their titles (with the exception of agriculturally-based biological engineering programs).

II.D.2. Faculty

II.D.2.a. Faculty Qualifications and Size (Amplifies criteria section I.C.1.b. and c.)

A faculty must be large enough to provide experience and capability in a significant portion of the broad range of bioengineering interests and to provide meaningful technical interaction among the faculty members so as to support these interests. The bioengineering program must be the responsibility of a faculty of at least four persons who by training and/or practice are competent in bioengineering and whose primary commitment is to the program. This faculty must have sufficient responsibility for the curriculum to accomplish appropriate program objectives.

II.D.2.b. Teaching Loads (Amplifies criteria section I.C.1.d.)

Teaching loads must leave time for continuing professional development of the faculty through activities such as bioengineering research, instructional innovation, engineering consulting, or sabbatical leaves.

II.D.3. Curriculum

II.D.3.a. Curricular Objective and Content (Amplifies criteria section I.C.2. and 3.)

Programs must require substantial work in basic engineering sciences, as well as work in the life sciences, which provide the framework for the interdisciplinary bioengineering courses. Programs with an emphasis in a single traditional engineering area, e.g. electrical, mechanics, chemical, and materials, must have some engineering course work outside that emphasis area.

II.D.3.b. Mathematics (Amplifies criteria section I.C.3.d. (1)(a))

At least one of the following additional topics is highly desirable: linear algebra and matrices, probability and statistics, numerical analysis, advanced calculus, and complex variables.

II.D.3.c. Basic Sciences (Amplifies criteria section I.C.3.c.(1)(b))

A minimum of one-fourth year of biology and one-fourth year of chemistry are expected.

II.D.3.d. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

The requirement for "one course which is primarily design, preferably at the senior level, and predicated on the accumulated background of the curricular components" can be satisfied in several ways. As a minimum, a course that satisfies this requirement must have a content that is more than one-half engineering design and must be in the junior or senior year of the program. It must not be a beginning course in the program but must have as a prerequisite at least one course in the discipline.

II.D.3.e. Laboratory Experience (Amplifies criteria section I.C.3.f.)

The bioengineering program must provide the student with a meaningful laboratory experience, which implies an emphasis on practical engineering problems as well as on the basic functioning of biological systems. In particular, bioengineering laboratories must include the unique problems associated with making measurements and interpreting data in living systems and should emphasize the importance of considering the interaction between living and non-living materials. An objective of the laboratory experience should be to educate engineers to be proficient in experimental work.

II.E. PROGRAM CRITERIA FOR CERAMIC AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the National Institute of Ceramic Engineers

II.E.1. Applicability

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

II.E.2. Faculty

II.E.2.a. Size of Faculty (Amplifies criteria section I.C.1.c.)

There must be a minimum of four full-time-equivalent faculty members, which may include the department head, whose primary commitments are to the basic-level program.

II.E.3. Curriculum

II.E.3.a. Curricular Objective and Content (Amplifies criteria section I.C.2. and 3.)

All programs in the materials disciplines shall reflect the emphasis indicated in the program modifiers. Programs designated as materials programs must include instruction in ceramic, metallic, polymeric, and composite materials.

II.E.3.b. Mathematics (Amplifies criteria section I.C.3.d.(1)(a))

Additional work in statistics or linear algebra or advanced calculus is required.

II.E.3.c. Basic Sciences (Amplifies criteria section I.C.3.d.(1)(b))

All programs must include one course year of college-level chemistry with laboratory, and one course year of college-level physics taught with calculus and laboratory. In addition, two courses chosen from advanced chemistry, advanced physics, or some other basic science must be an integral part of the program.

II.E.3.d. Engineering Sciences (Amplifies criteria section I.C.3.d.(3)(b))

The engineering sciences component must provide a coherent program of instruction including thermodynamics, material and energy balances, transport phenomena, statics, strength of materials, electrical and electronic circuits, and fundamental courses in the structure and properties of materials. A significant portion of the engineering sciences must be devoted to the production, processing, behavior, selection, and uses of materials.

II.E.3.e. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

Engineering design, with some treatment of engineering economics, must be an integral part of the curriculum. An important aspect of this requirement in all programs must be the design function as applied to processing.

The creative and original effort required for an effective design component can be met in several ways, such as through portions of courses, projects or research problems, or special problems that go beyond the limited activity of observation and analysis. However, a capstone engineering design experience in the final year of the program is required in order to integrate the various curricular components.

II.F. PROGRAM CRITERIA FOR CHEMICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Institute of Chemical Engineers

II.F.1. Applicability

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

II.F.2. Curriculum

II.F.2.a. Curricular Objective and Content (Amplifies criteria section I.C.2. and 3.)

Chemical engineers must receive thorough grounding in chemistry, and the chemistry courses they take should be the same as, or equivalent to, those taken by chemistry majors. An accreditable chemical engineering curriculum must include at least one-half year of advanced chemistry in addition to the usual two-semester (or three-quarter) freshman-level course in general chemistry. Up to one-eighth of an academic year of other advanced natural science may be substituted for advanced chemistry. Other advanced natural science must build on basic science prerequisites and may include physics, life sciences, and materials science. A portion of the advanced chemistry may be used to satisfy the basic science requirement as needed, and up to one-fourth of an academic year of advanced chemistry may be counted toward the engineering sciences requirement, provided that such advanced chemistry demonstrates an application of theory that qualifies it as chemical engineering science. In general, engineering science credits may not be used to satisfy the advanced chemistry requirement.

II.F.2.b. Engineering Sciences (Amplifies criteria section I.C.3.d.(3)(b))

A coherent plan of instruction in the chemical engineering sciences must be provided to include material and energy balances in chemical processes; thermodynamics with emphasis on physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage wise separation operations; and process dynamics and control. (Also see II.F.2.a. above.)

II.F.2.c. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

The various elements of the curriculum must be brought together in one or more capstone engineering design courses built around comprehensive, open-ended problems having a variety of acceptable solutions and requiring some economic analysis.

II.F.2.d. Computer Use (Amplifies criteria section I.C.3.g.)

Appropriate use of computers must be integrated throughout the program. Acceptable computer use will include most of the following: (1) programming in a high-level language; (2) use of software packages for analysis and design; (3) use of appropriate utilities such as editors; (4) simulation of engineering problems.

II.F.3. Administration and Institutional Commitment (Amplifies criteria sections I.C.5. and I.C.7.)

When the chemical engineering program is administered outside a school or college of engineering, it must be demonstrated that the program is guided by qualified chemical engineering faculty and that the budgetary support and freedom of action are equivalent to those ordinarily found in a department of an engineering school.

II.G. PROGRAM CRITERIA FOR CIVIL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Civil Engineers

II.G.1. Applicability

These program criteria apply to engineering programs which include "civil" and similarly modifiers in their titles.

II.G.2. Faculty

II.G.2.a. Teaching Loads (Amplifies criteria section I.C.1.d.)

A full-time faculty workload must reflect other appropriate activities, e.g., research, advising, institutional and committee service, and professional society responsibilities. The evaluation of the teaching load should reflect class size, modality of instruction, cost, instructional support, and contact hours.

II.G.2.b. Faculty Qualifications (Amplifies criteria section I.C.1.c.)

The minimum number of full-time civil engineering faculty members must be four (4). The primary assignment of these faculty members must be to the basic undergraduate program. The faculty as a whole must be competent in at least four (4) major discipline areas of civil engineering.

The majority of the full-time members of the civil engineering faculty who are eligible should be registered Professional Engineers. A majority of those faculty teaching courses which are primarily design in content must be registered Professional Engineers.

II.G.2.c. Faculty Participation (Amplifies criteria sections I.C.1. and I.C.3.j.)

Faculty members shall be involved with the professional development of students, providing students with the opportunity to interact with practitioners in their major fields of interest. Such opportunities could be provided through a student organization, or equivalent experience, that has the demonstrated support of the academic unit administering the program.

II.G.3. Curriculum

II.G.3.a. Curricular Objective and Content (Amplifies criteria section I.C.2. and 3.)

A minimum of one-half year is required in civil engineering courses. To achieve a broad base of coverage, a minimum of four of the major civil engineering discipline areas must be included in each student's program.

II.G.3.b. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

A minimum of one-half year of engineering design is required. The program is encouraged to develop innovative means of integrating design concepts and methodology throughout the curriculum, which must culminate in a major comprehensive design experience. Since the civil engineering design process generally involves a team approach, team design projects are highly recommended. The final design experience should include practitioner involvement whenever appropriate and possible. Student reports and presentations should be an integrated part of the final design experience.

II.G.3.c. Laboratory Experience (Amplifies criteria section I.C.3.f.)

The laboratory experience should be integrated with other learning situations and include such characteristics as creativity; team effort; open-ended decision making; use of oral and written communication skills; design of experimental procedures and processes; and use of experimental methods for problem solving, discovery and self-learning.

II.G.4. Student Body (Amplifies criteria section I.C.4.b.)

II.G.4.a. Transfer Credit

For a design course to be acceptable for transfer credit, its content must have been reviewed by a faculty member of the program seeking accreditation.

II.H. PROGRAM CRITERIA FOR CONSTRUCTION AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Civil Engineers

II.H.1. Applicability

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

II.H.2. Faculty

II.H.2.a. Teaching Loads (Amplifies criteria section I.C.1.d.)

A full-time faculty workload must reflect other appropriate activities, e.g., research, advising, institutional and committee service, and professional society responsibilities. The evaluation of the teaching load should reflect class size, modality of instruction, cost, instructional support, and contact hours.

II.H.2.b. Faculty Qualifications (Amplifies criteria section I.C.1.b.)

The faculty should include members who have had full-time experience and decision-making responsibilities in the construction industry and who are professionally registered or preparing for registration.

II.H.3. Curriculum

II.H.3.a. Curricular Objective and Content (Amplifies criteria sections I.C.2. and 3.)

A minimum of one-half year of course work must consist of management content, with topics such as economics, statistics, ethics, decision and optimization methods, process analysis and design, engineering management, safety, and cost engineering. If all or part of such topics satisfy ABET General and Program Criteria Curricula requirements, credit hours may be counted in both categories simultaneously.

II.H.3.b. Engineering Design (Amplifies criteria section I.C.3.d.(3)(c))

The one-half year in engineering design should provide a general grounding in the basics of the construction profession as well as permit some progress towards specialization.

II.I. PROGRAM CRITERIA FOR ELECTRICAL, ELECTRONIC(S), COMPUTER AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Institute of Electrical and Electronics Engineers, Inc.

II.I.1. Applicability

These program criteria apply to engineering programs which include "electrical," "electronic(s)," "computer" and similar modifiers in their titles.

II.I.2. Faculty

II.I.2.a. Size of Faculty (Amplifies criteria section I.C.1.c. and I.E.1.)

In addition to meeting the General Criteria, the faculty of a basic or advanced program must be sufficiently large and diversified to provide breadth in the field, and depth in accord with the stated objectives of the program. The faculty must have clearly defined responsibility for establishing curricular objectives and content, and be sufficiently dedicated to the program to assure that it will be kept up-to-date.

II.I.2.b. Faculty Qualifications

The major professional competence of the faculty for each program must span the range of topics associated with each program.

II.I.3. Curriculum

II.I.3.a. The structure of the curriculum must provide both breadth and depth across the field of topics implied by the title of the program. Programs containing computer in their title must include sufficient curricular breadth to provide a balanced view of hardware, software, hardware-software trade-offs, and basic modelling techniques used to represent the computing process. Breadth requires both the coverage of multiple topics as well as a balance of topics appropriate for the program. Depth requires both a series of topical areas that build upon one another as students progress through the program and a minimum of one topical area at an advanced level.

II.I.3.b. Mathematics (Amplifies criteria section I.C.3.d.(1)(a))

Additional study is required in one or more topical areas that are consistent with the title of the program, and sufficient for the goals and objectives of the program. These topics are to be appropriately distributed throughout the program.

II.J. PROGRAM CRITERIA FOR ENGINEERING MANAGEMENT AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Institute of Industrial Engineers (Lead Society in cooperation with the American Institute of Chemical Engineers, The American Society of Civil Engineers, The American Society of Mechanical Engineers, The Institute of Electrical and Electronics Engineers, Inc., Society of Manufacturing Engineers, Society of Petroleum Engineers).

II.J.1. Applicability

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

II.J.2. Faculty

II.J.2.a. Size of Faculty. (Amplifies criteria section I.C.1.c.)

The faculty group must be clearly identified and have curricular and administrative responsibility for the program sufficient to accomplish appropriate program objectives.

II.J.2.b. Teaching Loads. (Amplifies criteria section I.C.1.d.)

Teaching loads must allow sufficient time for faculty professional development and growth activities such as research, instructional innovation, consulting, publications, institutional service, and related professional activities.

II.J.2.c. Qualifications. (Amplifies criteria section I.C.1.b.)

The major professional competence of the faculty should rest in engineering and, in addition, the faculty should be experienced in the management of engineering and/or technical activities.

II.J.3. Curriculum

II.J.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The engineering management curriculum must emphasize the application of the management function in the technological setting while recognizing the basic and applied sciences in engineering systems. Emphasis shall be placed on the engineering relationships between the management tasks of organizing, staff, planning, financing, and the human element in production, research, and service organizations.

II.J.3.b. In the basic-level program, no more than three-fourths of one year of study may come from courses normally taught by schools of Business, Public Administration, Industrial Management, etc.

II.J.3.c. Mathematics. (Amplifies criteria section I.C.3.d.(1)(a))

Course work in mathematics must include study in the subject area of calculus-based probability and statistics.

II.J.3.d. Engineering Science and Design. (Amplifies criteria sections I.C.3.d.(3)(b) and (c))

The curriculum must include engineering management course content that complements the fulfillment of the engineering sciences and engineering design requirements as appropriate to an engineering management curriculum.

II.J.3.e. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

The program must include meaningful laboratory experiences that emphasize the integration of management systems into a series of different technological environments. Laboratory experiences in an environment of business and industry are encouraged.

II.J.3.f. Communication. (Amplifies criteria section I.C.3.i.)

A strong emphasis on communication skills including specific course work (i.e., written and oral presentations) is required.

II.J.3.g. Advanced level Programs. (Amplifies criteria section I.E.)

Programs at the advanced level must adhere to such requirements as apply to basic-level programs for faculty, communication, laboratories, computer use, and administration. No more than fifty percent of the graduate course work may come from courses normally taught by schools of Business, Public Administration, Industrial Management, etc.

II.J.4. Administration (Amplifies criteria section I.C.5.)

The faculty identified for this program must include a designated person who is responsible for managing and coordinating the program.

II.K. PROGRAM CRITERIA FOR ENGINEERING MECHANICS AND SIMILARLY NAMED PROGRAMS

Submitted by The American Society of Mechanical Engineers

(Lead Society in cooperation with the American Society of Civil Engineers and the Society of Automotive Engineers)

II.K.1. Applicability

These program criteria apply to engineering programs which include "engineering mechanics," "mechanics," "applied mechanics," "engineering science & mechanics," and similar modifiers including the word "mechanics" in their titles.

II.K.2. Faculty Qualifications and Size (Amplifies criteria sections I.C.1.b. and c.)

The minimum number of full-time faculty members shall be three who have demonstrated professional ability in engineering mechanics, and the majority of whom have had practical experience in a non-academic environment.

II.K.3. Curriculum

II.K.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The curriculum must include a sufficient number of free elective hours to allow students to undertake interdisciplinary studies in a special field, if they so choose. It should be designed to provide an understanding of the process of mathematical modeling coupled with digital and analog computer usage.

II.K.3.b. Mathematics. (Amplifies criteria section I.C.3.d.(1)(a))

At least one course in mathematics must be at the junior or senior level.

II.K.3.c. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

The curriculum must offer a coherent group of junior- and senior-level courses in each of the following engineering sciences areas: solid mechanics, fluid mechanics, dynamics and vibrations, and materials.

II.K.3.d. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

Design projects must be included in which students are exposed to design experiences involving at least two of the engineering sciences areas listed above.

II.L. PROGRAM CRITERIA FOR ENVIRONMENTAL, SANITARY AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Academy of Environmental Engineers (Lead Society in cooperation with the American Institute of Chemical Engineers, the American Society of Agricultural Engineers, the American Society of Civil Engineers, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, the American Society of Mechanical Engineers, the Society of Automotive Engineers, and the Society for Mining, Metallurgy, and Exploration)

II.L.1. Applicability

These program criteria apply to engineering programs which include "environmental," "sanitary," and similar modifiers in their titles.

II.L.2. Faculty Qualifications (Amplifies criteria section I.C.1.b.)

The majority of the engineering members of the environmental engineering faculty should be registered or should be Engineers-in-Training.

II.L.3. Curriculum

II.L.3.a. Curricular Objectives and Content. (Amplifies criteria section I.C.2. and 3.)

At least two areas of environmental engineering must be provided in the curriculum from among the following: air pollution control engineering; water and waste-water engineering; solid and hazardous wastes engineering; and environmental and occupational health engineering.

II.L.3.b. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

Design courses should emphasize an integrated approach that considers all environmental media in the prevention and control of environmental problems. System and facility operation and maintenance should be stressed in design courses. A minimum of one-half year of engineering design is required.

II.L.3.c. Laboratory Experience (Amplifies criteria section I.C.3.f.)

Environmental engineering laboratories must provide a relevant experience in the physical, chemical, and biological sciences. This experience should also include applications to processes utilized in environmental engineering.

II.M. PROGRAM CRITERIA FOR GEOLOGICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgy, and Exploration, Inc.

II.M.1. Applicability

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

II.M.2. Curriculum

II.M.2.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

Geological engineering encompasses but is not limited to (1) exploration for and development of mineral and fuel deposits, (2) geomechanics, (3) environmental site planning and/or natural hazard investigations, and (4) hydrogeology. The program in geological engineering must provide the integration of science, mathematics, engineering, and communication in comprehensive design courses, problems, and reports concerning geological engineering. The undergraduate program must include physical geology, mineralogy, introductory petrology, structural geology, principles of sedimentation or stratigraphy, field geology, and elements of geophysics.

II.M.2.b. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

The curriculum must include at least one course in (1) mechanics, including statics and properties of materials, and (2) geomechanics, along with appropriate prerequisites (i.e., subjects relating to the response of natural materials to deformation or application of stress and/or strain energy).

II.N. PROGRAM CRITERIA FOR INDUSTRIAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Institute of Industrial Engineers, Inc.

II.N.1. Applicability

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

II.N.2. Faculty

II.N.2.a. Faculty Qualifications and Size. (Amplifies criteria sections I.C.1.b. and c.)

A majority of the full-time-equivalent faculty members devoted to undergraduate teaching, counseling, and curriculum matters, and in no case fewer than three, must have at least one degree in industrial engineering.

II.N.2.b. Teaching Loads. (Amplifies criteria section I.C.1.d.)

A full-time faculty workload must reflect other appropriate activities, e.g., research, advising, institutional and committee service, and professional society responsibilities. The evaluation of the teaching load should reflect class size, modality of instruction, cost, instructional support, and contact hours.

II.N.3. Curriculum

II.N.3.a. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

A capstone engineering design experience is required.

II.N.3.b. Computer Use. (Amplifies criteria section I.C.3.g.)

Appropriate use of computers shall be integrated throughout the curriculum. Programming competence in a high-level language such as PASCAL, FORTRAN, or C, as well as simulation techniques, should be demonstrated.

II.N.3.c. Probability and Statistics. (Amplifies criteria section I.C.3.h.)

Calculus-based probability and statistics instruction shall be included.

II.N.4. Administration (Amplifies criteria section I.C.5.)

It must be demonstrated that the program is guided by qualified industrial engineering faculty with sufficient curricular and administrative control to achieve program objectives.

II.O. PROGRAM CRITERIA FOR MANUFACTURING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society of Manufacturing Engineers

II.O.1. Applicability

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

II.O.2. Faculty (Amplifies criteria sections I.C.1.b. and e.)

All manufacturing faculty members shall be suitably qualified by both education and experience and shall maintain knowledge of current manufacturing practice. The institution shall provide a statement of the methods and resources by which all manufacturing faculty develop and maintain current manufacturing expertise. Faculty members shall be involved with the professional development of students, providing students with the opportunity to interact with practitioners in their major fields of interest. Such opportunities could be provided through student organizations, or equivalent experiences, that have the demonstrated support of the academic unit administering the program.

II.O.3. Curricular Content

II.O.3.a. Basic-Level Curriculum. (Amplifies criteria section I.C.3.a.(3))

The courses in the major (those which identify a curriculum as manufacturing engineering) will normally require a minimum of one year of study. The major course work must include both engineering science and engineering design. The program must include at least one course in each of the four major areas listed below. The institution must provide a statement of program objectives and show how these objectives are met through integrated sequences of courses from these areas.

II.O.3.a.(1) Materials and manufacturing processes.

These courses study behavior and properties of materials and materials processing.

II.O.3.a.(2) Process, assembly, and product engineering.

These courses relate to the design of products and the equipment and tooling necessary for their manufacture.

II.O.3.a.(3) Manufacturing productivity and quality.

These courses deal with management of manufacturing enterprises. Topics such as productivity, quality, cost, human resources, product safety and liability, social concerns, international issues, environmental impact, and product life cycle may be included in this area.

II.O.3.a.(4) Manufacturing integration methods and systems design.

These courses deal with the design and operation of manufacturing systems. Simulation, modeling, control, architecture, and information systems are appropriate topics for this area.

II.O.3.b. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

II.O.3.b.(1) A minimum of one-half year of engineering design is required.

II.O.3.b.(2) A capstone engineering design experience that integrates specialty areas is required.

II.O.3.c. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

A hands-on laboratory experience in manufacturing processes where process variables are measured and technical inferences are made is required.

II.O.3.d. Advanced level Curriculum. (Amplifies criteria section I.E.)

The curriculum must contain a team experience, hands-on laboratory experience, and a thesis or project. The curriculum must include a minimum of one graduate-level course from each of the four major areas specified in 3.a. above for basic-level programs. The institution must provide a statement of program objectives and show how these objectives are met through its course requirements.

II.O.4. Administration (Amplifies criteria section I.C.5.)

II.O.4.a. Where the manufacturing engineering program is administered separately from a department titled "manufacturing engineering," or as an option within another department, the faculty must have sufficient curricular and administrative control to achieve program objectives.

II.O.4.b. An industrial advisory group is required with visible evidence of active support.

II.P. PROGRAM CRITERIA FOR

MATERIALS
AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Minerals, Metals, and Materials Society (Lead Society in cooperation with the National Institute of Ceramic Engineers, the American Institute of Chemical Engineers, and The American Society of Mechanical Engineers.)

II.P.1. Applicability

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

II.P.2. Faculty

II.P.2.a. Size of Faculty. (Amplifies criteria section I.C.1.c.)

There must be a minimum of four full-time-equivalent faculty members, which may include the department head, whose primary commitments are to the basic-level program.

II.P.3. Curriculum

II.P.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

All programs in the materials disciplines shall reflect the emphasis indicated in the program modifiers. Programs designated as materials programs must include instruction in ceramic, metallic, polymeric, and composite materials.

II.P.3.b. Mathematics. (Amplifies criteria section I.C..3.d.(1)(a))

Additional work in statistics or linear algebra or advanced calculus is required.

II.P.3.c. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b)

All programs must include one course year of college-level chemistry with laboratory, and one course year of college-level physics taught with calculus and laboratory. In addition, two courses chosen from advanced chemistry, advanced physics, or some other basic science must be an integral part of the program.

II.P.3.d. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

The engineering sciences component must provide a coherent program of instruction including thermodynamics, material and energy balances, transport phenomena, statics, strength of materials, electrical and electronic circuits, and fundamental courses in the structure and properties of materials. A significant portion of the engineering sciences must be devoted to the production, processing, behavior, selection, and uses of materials.

II.P.3.e. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

Engineering design, with some treatment of engineering economics, must be an integral part of the curriculum. An important aspect of this requirement in all programs must be the design function as applied to processing.

The creative and original effort required for an effective design component can be met in several ways, such as through portions of courses, projects, or research problems, or special problems that go beyond the limited activity of observation and analysis. However, a capstone engineering design experience in the final year of the program is required in order to integrate the various curricular components.

II.Q. PROGRAM CRITERIA FOR MECHANICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The American Society of Mechanical Engineers

II.Q.1. Applicability

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

II.Q.2. Faculty

II.Q.2.a. Faculty Qualifications and Size. (Amplifies criteria sections I.C.1.b. and c.)

Mechanical engineering programs must have at least five full-time faculty members who by training and/or practice are competent in mechanical engineering and whose primary responsibility is the instruction of undergraduate mechanical engineering students.

II.Q.2.b. Faculty Workload. (Amplifies criteria section I.C.1.d.)

A full-time faculty workload must reflect all appropriate activities, e.g., teaching, research, advising, institutional and committee service, and professional society responsibilities. The evaluation of the teaching load should reflect class size, modality of instruction, instructional support, and contact hours.

II.Q.2.c. Faculty Participation. (Amplifies criteria sections I.C.1. and I.C.3.j.)

Faculty members shall be involved with the professional development of students, providing students with the opportunity to interact with practitioners in their major fields of interest. Such opportunities could be provided through a student organization, or equivalent experience, that has the demonstrated support of the academic unit administering the program.

II.Q.3. Curriculum

II.Q.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The basic-level curriculum shall include two stems of coherent course offerings: (1) energy, and (2) structures and motion in mechanical systems.

II.Q.3.b. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

A coherent program shall include at least one course in the electrical sciences.

II.Q.3.c. Engineering Design. (Amplifies criteria sections I.C.3.d.(3) (c), (d), and (e))

It is required that some integrated educational experience in the terminal portion of the program be dedicated primarily or in its entirety to engineering design. Documented evidence of the student's participation must be provided for the visitor's evaluation.

II.Q.3.d. Computer Use. (Amplifies criteria section I.C.3.g.)

Graduates must have substantial experience in computer applications in both the energy and mechanical systems stems.

II.R. PROGRAM CRITERIA FOR METALLURGICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Minerals, Metals, and Materials Society (Lead Society in cooperation with the Society for Mining, Metallurgy, and Exploration, Inc.)

II.R.1. Applicability

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

All programs in the materials disciplines share these criteria, including programs with materials, materials processing, ceramics, glass, polymer, metallurgical, and similar modifiers in their titles.

II.R.2. Faculty

II.R.2.a. Size of Faculty. (Amplifies criteria section I.C.1.c.)

There must be a minimum of four full-time-equivalent faculty members, which may include the department head, whose primary commitments are to the basic-level program.

II.R.3. Curriculum

II.R.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

All programs in the materials disciplines shall reflect the emphasis indicated in the program modifiers. Programs designated as materials programs must include instruction in ceramic, metallic, polymeric, and composite materials.

II.R.3.b. Mathematics. (Amplifies criteria section I.C.3.d.(1)(a))

Additional work in statistics or linear algebra or advanced calculus is required.

II.R.3.c. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b))

All programs must include one course year of college-level chemistry with laboratory, and one course year of college-level physics taught with calculus and laboratory. In addition, two courses chosen from advanced chemistry, advanced physics, or some other basic science must be an integral part of the program.

II.R.3.d. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

The engineering sciences component must provide a coherent program of instruction including thermodynamics, material and energy balances, transport phenomena, statics, strength of materials, electrical and electronic circuits, and fundamental courses in the structure and properties of materials. A significant portion of the engineering sciences must be devoted to the production, processing, behavior, selection, and uses of materials.

II.R.3.e. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

Engineering design, with some treatment of engineering economics, must be an integral part of the curriculum. An important aspect of this requirement in all programs must be the design function as applied to processing.

The creative and original effort required for an effective design component can be met in several ways, such as through portions of courses, projects, or research problems, or special problems that go beyond the limited activity of observation and analysis. However, a capstone engineering design experience in the final year of the program is required in order to integrate the various curricular components.

II.S. PROGRAM CRITERIA FOR MINING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgy, and Exploration, Inc.

II.S.1. Applicability.

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

II.S.2. Faculty Qualifications and Size (Amplifies criteria sections I.C.1.b. and c.)

Minimum faculty size will be two individuals who are assigned full time to the mining program, and other mining faculty appointments equivalent to two full-time teaching positions. The background of the faculty must demonstrate a good balance between theoretical expertise and practical mining experience.

II.S.3. Curriculum

II.S.3.a. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b))

Instruction must include basic concepts in physical geology, structural geology, mineralogy, and petrology.

II.S.3.b. Engineering Sciences and Design. (Amplifies criteria sections I.C.3.d.(3)(b) and (c))

II.S.3.b.(1) Instruction in mining subjects must account for at least one year of all course work required for a bachelor's degree. Instruction must include mining methods, rock mechanics, rock fragmentation, materials handling, safety and mine environmental engineering, mineral or coal processing, mine surveying, and mine valuation.

II.S.3.b.(2) Instruction as individual courses or major topics within other courses must be provided in statics, dynamics, strength of materials, fluid mechanics, thermodynamics, and electrical circuits.

II.T. PROGRAM CRITERIA FOR NAVAL ARCHITECTURE AND MARINE ENGINEERING PROGRAMS

Submitted by the Society of Naval Architects and Marine Engineers

II.T.1. Applicability

These program criteria apply to engineering programs named "naval architecture" and/or "marine engineering."

II.T.2. Curriculum

II.T.2.a. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

Topics shall include fluid mechanics, solid mechanics, materials, hydrostatistics, dynamics, and energy systems. In some courses, applications to marine vehicles shall be included.

II.T.2.b. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

II.T.2.b.(1) Course work should include approximately one-half year of design which shall include one capstone design experience that integrates both pertinent and broad technical areas and addresses trade-off studies, economics, and systems aspects of design.

II.T.2.c. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

A meaningful laboratory program should provide experience with instrumentation for measuring physical phenomena related to naval architecture and/or marine engineering as well as emphasizing good experimental procedures such as experiment design, data collection, analysis, and formal report writing.

II.U. PROGRAM CRITERIA FOR NUCLEAR AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Nuclear Society

II.U.1. Applicability

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

II.U.2. Faculty Teaching Loads (Amplifies criteria section I.C.1.d.)

Teaching loads must leave enough time for conducting professional development of the faculty. Such professional development may include activities such as engineering research, instructional innovation, engineering consulting, sabbatical leaves, and related activities.

II.U.3. Curriculum

II.U.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The basic-level curriculum must provide a background in mathematics, chemistry, and physics followed by advanced study in mathematics and engineering sciences, including atomic and nuclear physics, leading to analysis, synthesis, design, and utilization of nuclear systems.

II.U.3.b. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

It is required that some integrated educational experience in the upper-division portion of the program be dedicated in its entirety to engineering design. Documented evidence of the students' participation must be provided for the visitor's evaluation.

II.U.3.c. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

The program must have a laboratory experience that includes nuclear processes.

II.U.4. Administration. (Amplifies criteria section I.C.5.)

There must be an identifiable faculty with sufficient curriculum and administrative control and budgetary support to achieve program objectives whether the program is administered as a department of nuclear engineering, an option within another engineering department, or outside a school or college of engineering.

II.V. PROGRAM CRITERIA FOR OCEAN AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society of Naval Architects and Marine Engineers
(Lead Society in cooperation with the American Society of Civil Engineers and
The Institute of Electrical and Electronics Engineers, Inc.)

II.V.1. Applicability

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

II.V.2. Curriculum

II.V.2.a. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b)

Topics shall include oceanography.

II.V.2.b. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b)

Topics shall include fluid mechanics, solid mechanics, materials, hydrostatics, dynamics, and energy systems. In some courses, applications to marine vehicles shall be included.

II.V.2.c. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

Course work should include approximately one-half year of design which shall include one capstone design experience that integrates both pertinent and broad technical areas and addresses trade-off studies, economics, and systems aspects of design.

II.V.2.d. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

A meaningful laboratory program should provide experience with instrumentation for measuring physical phenomena related to ocean engineering as well as emphasizing good experimental procedures such as experiment design, data collection, analysis, and formal report writing.

II.V.3. Size and Qualifications of Faculty (Amplifies criteria section I.C.1.b. and c.)

The faculty must be large enough to provide experience and capability in a significant portion of the broad range of ocean engineering.

II.V.4. Administration (Amplifies criteria section I.C 5.)

When the ocean engineering program is administered as a joint program in a multidisciplinary department or as an option under another engineering discipline, the program must have an identifiable faculty which has sufficient control over curriculum content and program administration to accomplish the program objectives.

II.W. PROGRAM CRITERIA FOR PETROLEUM AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society of Petroleum Engineers

II.W.1. Applicability

These program criteria apply to engineering programs which include “petroleum,” “natural gas,” or similar modifiers in their titles.

II.W.2. Curriculum

II.W.2.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The curriculum at the basic level must include a minimum of one year of petroleum engineering courses. Specific course sequences may be devised in a variety of ways. However, a satisfactory petroleum engineering curriculum must include the general areas described below.

II.W.2.a.(1) Well-drilling - modern design and operating practices for drilling oil and gas wells.

II.W.2.a.(2) Petroleum production - modern design and operating practices for completing, producing, and stimulating wells and for handling produced fluids at the surface.

II.W.2.a.(3) Properties of reservoir rocks and fluid - nature, estimation, and use of reservoir rock and fluid properties.

II.W.2.a.(4) Reservoir analysis and exploitation - application of modern reservoir engineering techniques to characterize and exploit petroleum reservoirs.

II.W.2.a.(5) Formation evaluation - use of well logs, cores, formation fluid samples, and pressure tests on wells to estimate reservoir rock and fluid properties.

II.W.2.a.(6) Economics - introduction to micro economics pertaining to the value of petroleum properties, economic analysis of projects, and the effect of economics on technical decisions.

II.W.2.a.(7) Geology - petroleum-related geological concepts including, as minimum, coverage in the areas of physical and structural geology.

II.W.2.b. Mathematics. (Amplifies criteria section I.C.3.d.(1)(a))

The curriculum should include at least one advanced mathematics topic such as linear algebra, probability and statistics, partial differential equations, numerical analysis, or advanced calculus.

II.W.2.c. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

The engineering sciences component must include topics in fluid mechanics, electrical circuits, strength of materials, and thermodynamics.

II.W.2.d. Laboratory Experience. (Amplifies criteria section I.C.3.f.)

The curriculum must provide the student with a meaningful laboratory experience emphasizing core analysis, PVT behavior, and fluid flow concepts. Additionally, a meaningful laboratory experience must be provided in at least two of the following areas: rheology, gas measurement, automation, drilling, logging, and formation evaluation.

II.W.2.e. Computer Use. (Amplifies criteria section I.C.3.g.)

Demonstration of computer proficiency in upper-level course work is required.

II.W.2.f. Advanced level Curriculum.

The advanced level curriculum must include a minimum of one-half year of advanced level courses in petroleum engineering as a supplement to the basic-level requirements.

II.X. PROGRAM CRITERIA FOR SURVEYING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Congress on Surveying and Mapping

(Lead Society in cooperation with the American Society of Civil Engineers)

II.X.1. Applicability

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

II.X.2. Faculty Qualifications (Amplifies criteria section I.C.1.b.)

It is expected that every surveying engineering faculty member will have had full-time experience in surveying or engineering practice in a non-academic environment. It is further expected that the faculty members in surveying who teach the design courses required for professional registration will be registered in the appropriate field.

II.X.3. Curriculum

II.X.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

In order to provide a broad overview of surveying and meet the requirements of surveying sciences and design, it is strongly recommended that at least one year of surveying be required.

II.X.3.b. Mathematics. (Amplifies criteria section I.C.3.d.(1)(a))

Course work in mathematics shall include matrix algebra and statistics.

II.X.3.c. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b))

Basic science course work shall include that part of physics which includes mechanics, heat, sound, light, optics, and electricity. A basic course in geology should be included. Chemistry, biology, and dendrology are suggested electives.

II.X.3.d. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

Care must be taken to include in this group such courses as geodesy, photogrammetry, electrical science as it relates to electronic distance measurement, and remote sensing.

II.X.3.e. Engineering Design. (Amplifies criteria section I.C.3.d.(3)(c))

The surveyor's relationship to design might relate to engineering as in hydraulic design, site planning, urban planning, or route and construction surveying. On the other hand, the design efforts might apply to survey systems (control), boundary location and relocation, survey evidence, and cartographic design. As the student chooses a course to meet career objectives, he or she should have one capstone design course which includes the elements mentioned in section I.C.3.d.(3) of the general criteria.

II.Y. PROGRAM CRITERIA FOR NONTRADITIONAL ENGINEERING PROGRAMS

II.Y.1. Applicability

These program criteria apply to engineering programs which are not covered by specific program criteria developed by a society or group of societies.

II.Y.2. Faculty (Amplifies criteria section I.C.1.)

II.Y.2.a. At least one year of course work taught by engineering faculty members should be taken by every student.

II.Y.2.b. In small institutions with strong departments of basic sciences and no other engineering programs, at least four faculty members educated as engineers or with extensive engineering experience are necessary to provide the engineering philosophy and application in the program.

II.Y.2.c. In institutions with a substantial number of faculty members educated as engineers and teaching in other departments, one or two engineering faculty members should be responsible for guidance and coordination of the nontraditional program.

II.Y.2.d. Advising. (Amplifies criteria section I.C.1.e.)

Students must be advised by faculty members who have been educated as engineers or who have extensive engineering experience.

II.Y.3. Curriculum

II.Y.3.a. Curricular Objective and Content. (Amplifies criteria section I.C.2. and 3.)

The content of a nontraditional, basic-level or advanced level engineering program must meet the general criteria and must conform to the definition of a program found in section II.B.3. of the *Accreditation Policy and Procedure Manual.* Both basic and advanced level programs must consist of a cohesive set of courses sequenced so that reasonable depth is obtained in the upper-level courses.

II.Y.3.b. Basic Sciences. (Amplifies criteria section I.C.3.d.(1)(b))

Programs that are identified with a particular science stem must give substantial emphasis to the specific science.

II.Y.3.c. Engineering Sciences. (Amplifies criteria section I.C.3.d.(3)(b))

A definite engineering stem must be obvious in the program and depth must be reached in pursuing courses in the engineering stem.

Furthermore, the program must develop the ability to apply pertinent knowledge to the practice of engineering.

II.Y.4. Administration (Amplifies criteria section I.C.5.)

The nontraditional program structures and content should be substantially determined by engineering faculty members with possible input from others related to the program. When programs are initiated by non-engineering departments, the engineering faculty should share at least an equal role in determining course sequences and content so that an engineering stem is clearly recognizable.

ENGINEERING CRITERIA 2000

Criteria for Accrediting Engineering Programs

Effective for Evaluations during the 2000-2001 Accreditation Cycle

I. GENERAL CRITERIA FOR BASIC LEVEL PROGRAMS

It is the responsibility of the institution seeking accreditation of an engineering program to demonstrate clearly that the program meets the following criteria.

Criterion 1. Students

The quality and performance of the students and graduates are important considerations in the evaluation of an engineering program. The institution must evaluate, advise, and monitor students to determine its success in meeting program objectives.

The institution must have and enforce policies for the acceptance of transfer students and for the validation of courses taken for credit elsewhere. The institution must also have and enforce procedures to assure that all students meet all program requirements.

Criterion 2. Program Educational Objectives

Each engineering program for which an institution seeks accreditation or reaccreditation must have in place:

(a) detailed published educational objectives that are consistent with the mission of the institution and these criteria
(b) a process based on the needs of the program's various constituencies in which the objectives are determined and periodically evaluated
(c) a curriculum and processes that ensure the achievement of these objectives
(d) a system of ongoing evaluation that demonstrates achievement of these objectives and uses the results to improve the effectiveness of the program.

Criterion 3. Program Outcomes and Assessment

Engineering programs must demonstrate that their graduates have:

(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
(d) an ability to function on multi-disciplinary 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 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.

Each program must have an assessment process with documented results. Evidence must be given that the results are applied to the further development and improvement of the program. The assessment process must demonstrate that the outcomes important to the mission of the institution and the objectives of the program, including those listed above, are being measured. Evidence that may be used includes, but is not limited to the following: student portfolios, including design projects; nationally-normed subject content examinations; alumni surveys that document professional accomplishments and career development activities; employer surveys; and placement data of graduates.

Criterion 4. Professional Component

The professional component requirements specify subject areas appropriate to engineering but do not prescribe specific courses. The engineering faculty must assure that the program curriculum devotes adequate attention and time to each component, consistent with the objectives of the program and institution. Students must be prepared for engineering practice through the curriculum culminating in a major design experience based on the knowledge and skills acquired in earlier course work and incorporating engineering standards and realistic constraints that include most of the following considerations: economic; environmental; sustainability; manufacturability; ethical; health and safety; social; and political. 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
(b) one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study
(c) a general education component that complements the technical content of the curriculum and is consistent with the program and institution objectives.

Criterion 5. Faculty

The faculty is the heart of any educational program. The faculty must be of sufficient number; and must 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 faculty must have sufficient qualifications and must ensure the proper guidance of the program and its evaluation and development. The overall competence of the faculty may be judged by such factors as education, diversity of backgrounds, engineering experience, teaching experience, ability to communicate, enthusiasm for developing more effective programs, level of scholarship, participation in professional societies, and registration as Professional Engineers.

Criterion 6. Facilities

Classrooms, laboratories, and associated equipment must be adequate to accomplish the program objectives and provide an atmosphere conducive to learning. Appropriate facilities must be available to foster faculty-student interaction and to create a climate that encourages professional development and professional activities. Programs must provide opportunities for students to learn the use of modern engineering tools. Computing and information infrastructures must be in place to support the scholarly activities of the students and faculty and the educational objectives of the institution.

Criterion 7. Institutional Support and Financial Resources

Institutional support, financial resources, and constructive leadership must be adequate to assure the quality and continuity of the engineering program. Resources must be sufficient to attract, retain, and provide for the continued professional development of a well-qualified faculty. Resources also must be sufficient to acquire, maintain, and operate facilities and equipment appropriate for the engineering program. In addition, support personnel and institutional services must be adequate to meet program needs.

Criterion 8. Program Criteria

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

II. COOPERATIVE EDUCATION CRITERIA

Should the program include as a part of the professional component a cooperative work element, this element of the program may be examined as a separate entity and reported as part of the accreditation action.

III. GENERAL CRITERIA FOR ADVANCED LEVEL PROGRAMS

Criteria for advanced level programs are the same as for basic level programs with the following additions: one year of study beyond the basic level and an engineering project or research activity resulting in a report that demonstrates both mastery of the subject matter and a high level of communication skills.

ENGINEERING CRITERIA 2000
PROGRAM CRITERIA

PROGRAM CRITERIA FOR
AEROSPACE
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Submitted by the American Institute of Aeronautics and Astronautics, Inc.

These program criteria apply to engineering program including "aerospace," "aeronautical," "astronautical," and similar modifiers in their titles.

1. Curriculum

Aeronautical engineering programs must demonstrate that graduates have a knowledge of aerodynamics, aerospace materials, structures, propulsion, flight mechanics, and stability and control.

Astronautical engineering programs must demonstrate that graduates 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 demonstrate that graduates 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 demonstrate that graduates have design competence which 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
Submitted by the American Society of Agricultural Engineers

These program criteria apply to engineering programs including "agricultural," agri-based "biological," "food," "forest," and similar modifiers in their titles.

1. Curriculum

Programs must demonstrate that graduates have proficiency in mathematics through differential equations, and relevant engineering sciences consistent with the discipline.

Agricultural engineering programs must demonstrate that graduates have a knowledge of appropriate agricultural and/or biological sciences, and/or natural resource topics. Competencies must be demonstrated in relevant fields such as; biological materials, computer and automatic control systems, information systems, machine systems, modified environment design, natural resource systems, processing systems, and structural design.

Biological engineering programs must demonstrate that graduates have knowledge of appropriate inorganic and organic chemistry, biochemistry, and biological science topics. Competencies must be demonstrated in relevant fields such as; biological kinetics, biological materials, biological systems, biomedical systems, bioprocessing, computer and automatic control systems, information systems, machine systems, and natural resource systems.

Food engineering programs must demonstrate that graduates have a knowledge of appropriate organic and physical chemistry, and biological science topics. Competencies must be demonstrated in relevant fields such as; biological kinetics, biological materials, heat and mass transfer systems, information systems, process control systems, and processing systems.

Forest engineering programs must demonstrate that graduates have a knowledge of appropriate forest science topics. Competencies must be developed in relevant fields such as; computer and automatic control systems, information systems, ecological and silvicultural systems, harvesting systems, hydrology, natural resources and environmental systems, processing, transportation and access systems, and water resources.

Similarly named engineering programs must demonstrate that graduates have a knowledge of appropriate agricultural and/or biological science, chemistry, and natural resource topics. Competencies must be demonstrated in relevant fields such as; aquacultural systems, biological processes and systems, computer and automatic control systems, information systems, machine systems, modified environment design, natural resource systems, processing systems, and structural design.

2. Faculty

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

PROGRAM CRITERIA FOR ARCHITECTURAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Civil Engineers
(Lead Society in cooperation with The American Society of Heating, Refrigerating, and Air- Conditioning Engineers, Inc.)

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

1. Curriculum

The program must demonstrate that graduates have: proficiency in mathematics through differential equations, probability and statistics, calculus-based physics, and general chemistry; proficiency in statics, strength of materials, thermodynamics, fluid mechanics, electric circuits, and engineering economics; proficiency in a minimum of two (2) of the three (3) basic curriculum areas of structures, building mechanical and electrical systems, and construction/construction management; engineering design capabilities in at least two (2) of the three (3) basic curriculum areas of architectural engineering, and that design has been integrated across the breadth of the program; an understanding of architectural design and history leading to architectural design that will permit communication, and interaction, with the other design professionals in the execution of building projects.

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 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 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 AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Institute of Electrical and Electronics Engineers, Inc.
(Lead Society in cooperation with the American Institute of Chemical Engineers, the American Society of Agricultural Engineers, The American Society of Mechanical Engineers, and the National Institute of Ceramic Engineers)

These program criteria apply to bioengineering programs and others including "biomedical" and similar modifiers in their titles with the exception of agriculturally-based engineering programs.

1. Curriculum

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

The program must demonstrate that graduates have: an understanding of biology and physiology, and the capability to apply advanced mathematics (including differential equations and statistics), science, and engineering to solve the problems at the interface of engineering and biology; the ability to make measurements on and interpret data from living systems, addressing the problems associated with the interaction between living and non-living materials and systems.

PROGRAM CRITERIA FOR CERAMIC AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the National Institute of Ceramic Engineers

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems; an integrated understanding of scientific and engineering principles underlying the four major elements of the field, viz. structure, properties, processing, and performance related to the material systems appropriate to the field; the ability to apply and integrate knowledge from each of the above four elements of the field to solve material selection and design problems; the ability to utilize experimental, statistical, and computational methods consistent with the goals of the program.

2. Faculty

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

PROGRAM CRITERIA FOR CHEMICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Institute of Chemical Engineers

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

1. Curriculum

The program must demonstrate that graduates have: thorough grounding in chemistry and a working knowledge of advanced chemistry such as organic, inorganic, physical, analytical, materials chemistry, or biochemistry, selected as appropriate to the goals of the program; working knowledge, including safety and environmental aspects, of material and energy balances applied to chemical processes; thermodynamics of physical and chemical equilibria; heat, mass, and momentum transfer; chemical reaction engineering; continuous and stage-wise separation operations; process dynamics and control; process design; and appropriate modern experimental and computing techniques.

PROGRAM CRITERIA FOR CIVIL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Society of Civil Engineers

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

1. Curriculum

The program must demonstrate that graduates have: proficiency in mathematics through differential equations; probability and statistics; calculus-based physics; and general chemistry; proficiency in a minimum of four (4) recognized major civil engineering areas; the ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the recognized major civil engineering areas; the ability to perform civil engineering design by means of design experiences integrated throughout the professional component of the curriculum; an understanding of professional practice issues such as: procurement of work; bidding versus quality based selection processes; how the design professionals and the construction professions interact to construct a project; the importance of professional licensure and continuing education; and/or other professional practice issues.

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

Submitted by the American Society of Civil Engineers

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

1. Curriculum

The program must demonstrate the graduates have: proficiency in mathematics through differential and integral calculus, probability and statistics, general chemistry, and calculus-based physics; proficiency in engineering design in a construction engineering specialty field; an understanding of legal and professional practice issues related to the construction industry; an understanding of construction processes, communications, methods, materials, systems, equipment, planning, scheduling, safety, cost analysis, and cost control; an understanding of management topics such as economics, business, accounting, law, statistics, ethics, leadership, decision and optimization methods, process analysis and design, engineering economics, engineering management, safety, and cost engineering.

2. Faculty

The program must demonstrate that the majority of faculty teaching courses which 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, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Institute of Electrical and Electronics Engineers, Inc.

These program criteria apply to engineering programs which include electrical, electronic, computer, 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 program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; knowledge of mathematics through differential and integral calculus, basic sciences, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.

Programs containing the modifier “electrical” in the title must also demonstrate that graduates have a knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

Programs containing the modifier “computer” in the title must also demonstrate that graduates have a knowledge of discrete mathematics.

PROGRAM CRITERIA FOR ENGINEERING MANAGEMENT AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Institute of Industrial Engineers, Inc.

(Lead Society in cooperation with the American Institute of Chemical Engineers, The American Society of Civil Engineers, The American Society of Mechanical Engineers, The Institute of Electrical and Electronics Engineers, Inc., the Society of Manufacturing Engineers, and the Society of Petroleum Engineers)

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

1. Curriculum

The program must demonstrate that graduates have: an understanding of the engineering relationships between the management tasks of planning, organization, leadership, control, and the human element in production, research, and service organizations; an understanding of and dealing with the stochastic nature of management systems. They must also be capable of demonstrating the integration of 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

Submitted by The American Society of Mechanical Engineers

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

1. Curriculum

The program must demonstrate that graduates have the ability 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 responsible for the upper-level professional program are maintaining currency in their specialty area.

PROGRAM CRITERIA FOR ENVIRONMENTAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Academy of Environmental Engineers
(Lead Society in cooperation with the American Institute of Chemical Engineers, The American Society of Agricultural Engineers, The American Society of Civil Engineers, the American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., The American Society of Mechanical Engineers, the Society of Automotive Engineers, and the Society for Mining, Metallurgy, and Exploration, Inc.)

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

1. Curriculum

The program must demonstrate the graduates have: knowledge of fundamental concepts of waste minimization and pollution prevention; an understanding of the roles and responsibilities of public institutions and private organizations in environmental management; capability to apply environmental systems and process modeling techniques; proficiency in mathematics through differential equations, probability and statistics, calculus-based physics, general chemistry, an earth science (e.g., geology, meteorology, soil science) relevant to the program of study, a biological science (e.g., microbiology, aquatic biology) relevant to the program of study, and fluid mechanics relevant to the program of study; knowledge of introductory level fundamentals in the following major focus areas: water supply and resources, environmental systems modeling, environmental chemistry, wastewater management, solid waste management, hazardous waste management, atmospheric systems and air pollution control, and environmental and occupational health; an ability to conduct laboratory experiments and to critically analyze and interpret data in more than one of the major environmental engineering focus areas; an ability to perform engineering design by means of design experiences integrated throughout the professional component of the curriculum; proficiency in advanced principles and practice in a minimum of three of the major focus areas listed above; understanding of concepts of professional practice such as procurement, bidding versus quality-based selection processes, interaction of project design and construction professionals, and the importance of professional licensing and continuing education.

2. Faculty

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

PROGRAM CRITERIA FOR GEOLOGICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgical, and Exploration, Inc.

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics through applications to geological engineering applications; proficiency in geological science topics that emphasize understanding of geologic principles and processes, the identification of minerals and rocks, elements of geophysics, field geology, and the ability to visualize and solve geological problems of a three-dimensional nature; proficiency in the engineering sciences including statics, properties/strength of materials, and geo-mechanics; the ability to apply the principles of geology to design solutions to geological engineering problems, which include one or more of the following considerations: the physical properties of the materials of the earth's crust including hydrogeology; the effects of the processes that form the earth's crust; and the impacts of construction projects, exploration for and exploitation of resources, disposal of wastes, and other activities of society on these materials and processes, as appropriate to the program objectives.

PROGRAM CRITERIA FOR INDUSTRIAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Institute of Industrial Engineers, Inc.

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

1. Curriculum

The program must demonstrate that graduates have the ability to design, develop, implement and improve integrated systems that include people, materials, information, equipment and energy.

The program 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

Submitted by the Society of Manufacturing Engineers

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

1. Curriculum

The program must demonstrate that graduates have proficiency in materials and manufacturing processes: understanding the behavior and properties of materials as they are altered and influenced by processing in manufacturing; process, assembly and product engineering: understanding the design of products and the equipment, tooling and environment necessary for their manufacture; manufacturing competitiveness: understanding the creation of competitive advantage through manufacturing planning, strategy and control; manufacturing systems design: understanding the analysis, synthesis and control of manufacturing operations using statistical and calculus based methods; laboratory experience: graduates must be able to measure manufacturing process variables in a manufacturing laboratory and make technical inferences about the process.

2. Faculty

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

PROGRAM CRITERIA FOR MATERIALS[1], METALLURGICAL[2], AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Minerals, Metals & Materials Society

([1]Lead Society for Materials Engineering in cooperation with the National Institute of Ceramics Engineers, the American Institute of Chemical Engineers, and The American Society of Mechanical Engineers)

([2]Lead Society for Metallurgical Engineering in cooperation with the Society for Mining, Metallurgy, and Exploration, Inc.)

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply advanced science (such as chemistry and physics) and engineering principles to materials systems implied by the program modifier, e.g., ceramics, metals, polymers, composite materials, etc.; an integrated 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; the ability to apply and integrate knowledge from each of the above four elements of the field to solve materials selection and design problems; the ability to utilize experimental, statistical and computational methods consistent with the goals of the program.

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

Submitted by The American Society of Mechanical Engineers

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

1. Curriculum

The program must demonstrate that graduates have: knowledge of chemistry and calculus-based physics with depth in at least one; the ability to apply advanced mathematics through multivariate calculus and differential equations; familiarity with statistics and linear algebra; the ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

2. Faculty

The program must demonstrate that faculty responsible for the upper-level professional program are maintaining currency in their specialty area.

PROGRAM CRITERIA FOR MINING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgy, and Exploitation, Inc.

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics as applied to mining engineering problems applications; fundamental knowledge in the geological sciences including characterization of mineral deposits, physical geology, structural or engineering geology, and mineral and rock identification and properties; proficiency in statics, dynamics, strength of materials, fluid mechanics, thermodynamics, and electrical circuits; proficiency 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; proficiency 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 lead to proficiency in geologic concepts, rock mechanics, mine ventilation, and other topics appropriate to the program objectives.

PROGRAM CRITERIA FOR NAVAL ARCHITECTURE, MARINE ENGINEERING, AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society of Naval Architects and Marine Engineers

These program criteria apply to engineering programs named naval architecture and/or marine engineering and similar modifiers in their titles.

1. Curriculum

The program must demonstrate that graduates have: the ability to apply probability and statistical methods to naval architecture and marine engineering problems; basic knowledge of fluid mechanics, dynamics, structural mechanics, materials properties, hydrostatics, and energy/propulsion systems in the context of marine vehicles; 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

Submitted by the American Nuclear Society

These program criteria apply to engineering programs including nuclear, radiological or similar modifiers in their titles.

1. Curriculum

The program must demonstrate that graduates have: the ability 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; ability to measure nuclear and radiation processes; ability 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 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

Submitted by the Society of Naval Architects and Marine Engineers
(Lead Society in cooperation with the American Society of Civil Engineers and
The Institute of Electrical and Electronics Engineers, Inc.)

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

1. Curriculum

The program must demonstrate that graduates have: 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; the ability 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 PETROLEUM AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society of Petroleum Engineers

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

1. Curriculum

The program must demonstrate that graduates have competency 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; 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

Submitted by The Institute of Electrical and Electronics Engineers, Inc.

These program criteria apply to engineering programs which 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 program must demonstrate that graduates have: the ability to analyze, design, verify, validate, implement, apply, and maintain software systems; the ability to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer and management sciences to complex software systems.

PROGRAM CRITERIA FOR SURVEYING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the American Congress on Surveying and Mapping
(Lead Society in cooperation with the American Society of Civil Engineers)

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

1. Curriculum

The program must demonstrate that graduates have competency 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 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.

PROPOSED CHANGES TO ENGINEERING CRITERIA 2000

The following section presents proposed changes to Engineering Criteria 2000. These proposals were approved by the Engineering Accreditation Commission (EAC) and were brought before the ABET Board of Directors on October 30, 1999 for preliminary approval. Before being approved for final implementation in the accreditation process, these proposals are published here for circulation among the institutions with accredited programs and other interested parties for review and comment.

Comments will be considered until June 15, 2000. The ABET Board of Directors 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 Annual Meeting in the fall of 2000 and will first be applied by the EAC for accreditation actions during the 2001-2002 academic year and the following years.

Comments relative to the proposed general and program criteria changes should be addressed to: Accreditation Director, Accreditation Board for Engineering and Technology, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012.

PROPOSED CHANGES TO COOPERATIVE EDUCATION CRITERIA OF ENGINEERING CRITERIA 2000

II. Cooperative Education Criteria

The Engineering Accreditation Commission has determined that the outcomes associated with cooperative education programs may be evaluated in the context of Criterion 3 (Program Outcomes and Assessment); consequently, the explicit accreditation of cooperative education programs does not appear to be warranted. If approved by the ABET Board of Directors on second reading, Criterion II (Cooperative Education Criteria) will be deleted and the explicit accreditation of cooperative education programs will be discontinued effective with the 2001-2002 accreditation cycle.

Addendum
To

CRITERIA FOR ACCREDITING
ENGINEERING
PROGRAMS

Effective for Evaluations During the
2000-01 Accreditation Cycle

The attached proposed program criteria changes for:

Electrical, Computer and Similarly Named Engineering Programs
Geological and Similarly Named Engineering Programs
Mining and Similarly Named Engineering Programs
Software and Similarly Named Engineering Programs

were endorsed by the Engineering Accreditation Commission at its 1999 Summer Meeting. These program criteria apply to EC2000.

Unfortunately, these proposed changes were inadvertently omitted from the materials submitted to the Board of Directors for consideration at its meeting of October 30, 1999. At its meeting of March 18, 2000, the Board of Directors gave preliminary approval to these changes and, further, provided that the second reading of these changes would occur at the October 28, 2000, meeting of the Board of Directors.

Comments relative to these proposed program criteria changes should be addressed to: Accreditation Director, Accreditation Board for Engineering and Technology, Inc., 111 Market Place, Suite 1050, Baltimore, MD 21202-4012.

PROPOSED PROGRAM CRITERIA FOR
ELECTRICAL, COMPUTER,
AND SIMILARLY NAMED ENGINEERING PROGRAMS
Submitted by The Institute of Electrical and Electronics Engineers, Inc.

These program criteria apply to engineering programs which include electrical, electronic, computer, 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 program must demonstrate that graduates have: knowledge of probability and statistics, including applications appropriate to the program name and objectives; and knowledge of mathematics through differential and integral calculus, basic sciences, computer science, and engineering sciences necessary to analyze and design complex electrical and electronic devices, software, and systems containing hardware and software components, as appropriate to program objectives.

Programs containing the modifier "electrical" in the title must also demonstrate that graduates have a knowledge of advanced mathematics, typically including differential equations, linear algebra, complex variables, and discrete mathematics.

Programs containing the modifier "computer" in the title must also demonstrate that graduates have a knowledge of discrete mathematics.

PROPOSED PROGRAM CRITERIA FOR GEOLOGICAL AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgical, and Exploration, Inc.

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics through applications to geological engineering applications; proficiency in geological science topics that emphasize understanding of geologic principles and processes, the identification of minerals and rocks, elements of geophysics, field geology, and the ability to visualize and solve geological problems of a three-dimensional nature; proficiency in the engineering sciences including statics, properties/strength of materials, and geo-mechanics; the ability to apply the principles of geology to design solutions to geological engineering problems, which include one or more of the following considerations: the physical properties of the materials of the earth's crust including hydrogeology; the effects of the processes that form the earth's crust; and the impacts of construction projects, exploration for and exploitation of resources, 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 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.

PROPOSED PROGRAM CRITERIA FOR MINING AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by the Society for Mining, Metallurgy, and Exploration, Inc.

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

1. Curriculum

The program must demonstrate that graduates have: the ability to apply mathematics through differential equations, calculus-based physics, general chemistry, and probability and statistics as applied to mining engineering problems applications; fundamental knowledge in the geological sciences including characterization of mineral deposits, physical geology, structural or engineering geology, and mineral and rock identification and properties; proficiency in statics, dynamics, strength of materials, fluid mechanics, thermodynamics, and electrical circuits; proficiency 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; proficiency 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 lead to proficiency in geologic concepts, rock mechanics, mine ventilation, and other topics appropriate to the program objectives.

3. 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 SOFTWARE AND SIMILARLY NAMED ENGINEERING PROGRAMS

Submitted by The Institute of Electrical and Electronics Engineers, Inc.

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

2. 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 program must demonstrate that graduates have: the ability to analyze, design, verify, validate, implement, apply, and maintain software systems; the ability to appropriately apply discrete mathematics, probability and statistics, and relevant topics in computer science and supporting disciplines to complex software systems; and the ability to work in one or more significant application domains.

3. Faculty

The program shall demonstrate that those faculty teaching core software engineering material have practical software engineering experience.