INSTITUTION OF ENGINEERS SINGAPORE

ENGINEERING ACCREDITATION BOARD

ACCREDITATION MANUAL

(For evaluation visits after August 2011)

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PART I
ENGINEERING ACCREDITATION BOARD

1 INTRODUCTION

1.1 The Engineering Accreditation Board (EAB) was set up by the Institution of Engineers Singapore (IES) to be the body for accreditation of engineering degree programmes. It is a non-governmental organisation and has the support of key stakeholders in the engineering profession.

1.2 EAB will work closely with stakeholders to ensure that the programmes serve to equip graduates with a sound knowledge of fundamentals of the discipline, and to develop in them an acceptable level of professional competence such as would meet the needs of the profession locally and be adequate for the responsible fulfilment of engineering assignments globally.

1.3 The IES, through the EAB, is a full signatory of the Washington Accord with effect from year 2006. The Washington Accord is an international agreement among bodies responsible for accrediting engineering degree programmes. It recognizes the substantial equivalency of programmes accredited by those bodies and recommends that graduates of programmes accredited by any of the signatory bodies be recognized by the other bodies as having met the academic requirements for entry to the practice of engineering.

2 COMPOSITION OF ENGINEERING ACCREDITATION BOARD (EAB)

2.1 EAB is constituted as a multi-agency body which is led by IES. The IES President shall be an ex-officio member of EAB. Other members of EAB shall be appointed by IES President in consultation with the various stakeholders for a period of three years in accordance with the following composition as prescribed in the Constitution of The Institution of Engineers, Singapore:

i) Three Members (3) from IES
ii) Three Members (3) from Professional Engineers Board, Singapore (PEB)
iii) One Member (1) from Association of Consulting Engineers, Singapore (ACES)
iv) One Member (1) from National University of Singapore (NUS)
v) One Member (1) from Nanyang Technological University (NTU)
vi) One Member (1) from another university with engineering programmes
vii) One Member (1) from among relevant government agencies or non-government organizations

2.2 The EAB Chair is elected by the EAB Members from among the 3 appointed members from IES only, and shall hold office for the duration of his appointment as EAB member.

2.3 The terms of reference of EAB are:

(i) to implement the accreditation policy of the Council of IES;
(ii) to formulate guidelines and procedures for accreditation;
(iii) to appoint an Evaluation Team to accredit each engineering programme;
(iv) to receive and review evaluation reports by the Evaluation Teams, and decide on whether accreditation should be granted, as well as the conditions to be imposed, if there is such a need;
(v) to respond to the Council of IES on complaints and appeals regarding the accreditation process;
(vi) to represent IES in mutual recognition agreements on academic qualifications with other countries;
(vii) to report periodically to the Council of IES on its work.

PART II
ACCREDITATION POLICY

3 OBJECTIVES OF ACCREDITATION

3.1 The objectives of accreditation by EAB are:

(i) to ensure that accredited programmes satisfy the requirements for corporate membership of the Institution of Engineers Singapore in the area of academic qualifications and are benchmarked to meet the standards of other mutual recognition agreements entered into by EAB, including the Washington Accord;

(ii) to assist stakeholders as well as potential students and their parents, professional societies, and potential employers, in identifying specific engineering programmes that meet the minimum criteria for accreditation; and

(iii) to provide feedback to the educational institutions for the improvement and development of educational programmes in engineering that can better meet the needs of the industry.

4 ACCREDITATION POLICY

4.1 The following general policies will be the guiding principles for the accreditation of engineering programmes:

(i) Programmes, instead of educational institutions, are accredited. Only programmes leading to an undergraduate degree in engineering would be accredited.

(ii) Programmes to be accredited should be offered by an educational institution of higher learning which has been formally approved as an educational institution by the appropriate authority in the state.

(iii) The title of a programme to be accredited shall be the same as that shown on the graduating student's certificate and transcript. All routes leading to the completion of the programme will have to satisfy the accreditation criteria. An evening or part-time programme may also be accredited along with the regular full-time on-campus programme provided it offers the same curriculum and processes, laboratory facilities and physical learning environment, and same standards of grading.

(iv) Programmes which have produced graduates for at least two academic years will be considered for full accreditation. However, new programmes could be considered for provisional accreditation in accordance with paragraph 6.

(v) Programmes are considered for review and accreditation only at the written request of the educational institution.

(vi) Accreditation of a programme will normally be granted for a specific term of up to a maximum of five years. If there is uncertainty as to the status, nature or future of the programme, or some weaknesses exist which calls for a review at a shorter interval, accreditation may be granted for a shorter term of two or three years.

(vii) A comprehensive review will be carried out at regular intervals not exceeding five years. If there are significant changes to the programme or a substantial problem is brought to notice, an interim review focussing on the problems may be conducted. In the event that any aspect of the programme is found to be sufficiently unsatisfactory, the EAB reserves the rights to revoke the accreditation.

(viii) The educational institution that offers an accredited course shall advise the EAB if significant changes have been made to the content, mode of delivery, outcomes or any aspect of the accredited course.

(ix) Programmes will be evaluated in accordance with the accreditation criteria given in Part IV. Accreditation is based on satisfying the minimum standards.

(x) All correspondence between the educational institution and EAB, as well as information as to whether a programme from an educational institution is being considered for accreditation, are to be classified as confidential and may not be released to any unauthorised persons except with written permission from the educational institution.

(xi) An on-site visit will form part of the process leading to an accreditation decision. An evaluation team appointed by the EAB will carry out the evaluation of the programme. The evaluation team may include observers, subject to agreement by both EAB and the educational institution.

(xii) The final decision made by EAB will be communicated to the educational institution together with feedback and comments. In the event that a programme is not accredited, reasons for the decision will be given. If accreditation is denied, the educational institution may appeal against the decision or request an immediate re-evaluation.

(xiii) The academic programme should be equivalent to a 4-year full-time course. A one-year full-time study shall be taken to be equivalent to 32 semester credit hours or 25% of total credits for degree program, whichever is less.

(xiv) The educational institution is expected to bear the cost of accreditation.

PART III
ACCREDITATION PROCEDURE

5 ACCREDITATION PROCESS

5.1 The accreditation process, whether for a first accreditation or re-accreditation, involves a comprehensive assessment which comprises the following:

(i) a review of the information submitted in accordance with the Report on Accreditation Information as prescribed in Part V;

(ii) an on-site accreditation visit by the Evaluation Team appointed by EAB; and

(iii) preparation of the accreditation report on findings and recommendations by the Evaluation Team.

5.2 Generally, the steps involved in the accreditation process are as follows:

(i) The educational institution will make an application to EAB for accreditation of its programme. When the application for accreditation is accepted by EAB, the education institution will prepare and submit the relevant Report on Accreditation Information, as prescribed in Part V, at least eight (8) weeks before the desired accreditation date. If a programme is already accredited and a re-evaluation is necessary, the application for re-accreditation is to be submitted at least 5 months before expiry of the accreditation;

(ii) EAB will form an Evaluation Team to evaluate the submitted information. The Team will be headed by a Team Leader, and the number of members on the Evaluation Team will depend on the programme to be accredited. EAB will adopt the following guidelines in determining the composition of the Evaluation Team:

a) an academic (or formerly an academic) member, preferably to be a representative from an overseas signatory of Washington Accord;
b) a member from the relevant industry to be selected from key stakeholders (such as the Professional Engineers Board, regulatory agencies, academia and industry, including the Association of Consulting Engineers Singapore);
c) a member who is familiar with EAB's accreditation system, and who need not be from the same branch of engineering as the programme to be accredited;
d) the Team Leader should not be a current academic in an educational institution in Singapore; and
e) a secretary who shall assist the Team in carrying out its work.

(iii) The Evaluation Team may, after evaluating the submitted information, request for additional information, where necessary.

(iv) If the information provided is sufficient, the Evaluation Team Leader will request the Secretary of the Evaluation Team to liaise with the educational institution to develop a schedule or programme for an on-site visit. A possible schedule which should serve as a guide in developing the programme for the on-site visit is in Annex 1;

(v) If observers are to be included in the on-site visit, the Secretary of the Evaluation Team will seek prior written consent from the educational institution;

(vi) The Evaluation Team will carry out the on-site visit, which could take between one to three days;

(vii) The Evaluation Team will meet, prepare and submit its report to EAB within 4 weeks after the on-site visit;

(viii) Before submitting its report to EAB, the Evaluation Team will submit a draft report to the educational institution for correction of errors of fact prior to issue in its final form. The educational institution could also respond by presenting its plans for future changes or improvements. The Evaluation Team will also forward the information provided by the educational institution to EAB together with its final report.

(ix) On the basis of the report by the Evaluation Team, a decision on accreditation will be made by EAB. The educational institution will be informed of the decision by EAB.

(x) An appeal against the decision of EAB will have to be submitted in writing within 30 days (see paragraph 9 for details).

6 PROVISIONAL ACCREDITATION OF NEW PROGRAMMES

6.1 Provisional accreditation may be considered for new programmes. The accreditation procedure will vary depending on whether the educational institution already has other programmes which had been granted full accreditation by EAB.

6.2 For programmes offered by a new educational institution, it is preferable that an on-site accreditation visit be carried out only after completion of the first two years of delivery of the programme. However, a new educational institution can request EAB to carry out an on-site accreditation visit to review a programme for provisional accreditation when the programme is in its first year of delivery provided it has the majority of the resources in place for delivery of the programme for the full course at all levels. This will allow the Evaluation Team to review the curriculum of the full programme, and assess the quality of the academic staff and other resources such as library and laboratories.

6.3 Provisional accreditation may be granted for a specified time frame, which can be a specified period of time or up to the time when the educational institution has produced graduates for two academic years. If the educational institution does not request a follow-up accreditation visit within the specified time frame the provisional accreditation will lapse. The follow-up accreditation visit will normally be conducted by

an Evaluation Team which will comprise at least one member who had reviewed the programme previously.

6.4 During the period of provisional accreditation, all graduates of the programme will not be deemed to have gained a qualification recognised by EAB as meeting EAB's accreditation requirements. Hence, their qualification would not be recognised through any mutual recognition agreement entered into by EAB, such as the Washington Accord.

6.5 When a programme moves from provisional to full accreditation, graduates of the programme will be considered as possessing an engineering qualification accredited by EAB even though they could have graduated whilst the programme was provisionally accredited by EAB, that is, the accreditation will be retrospective.

6.6 For each programme which is given provisional accreditation, the educational institution is expected to provide an annual report to EAB on progress made in relation to the recommendations and requirements made in the provisional accreditation report. EAB may appoint a member from the Evaluation Team to act as a monitor, and the monitor may be expected to visit the educational institution on an annual basis and provide a report to EAB on his findings. The educational institution will be expected to meet all direct costs associated with the visits by the monitor.

7 ACCREDITATION VISIT

7.1 The on-site visit will allow the Evaluation Team to assess factors related to the accreditation criteria that may not be adequately described in the Report on Accreditation Information, and to obtain further clarifications from the educational institution. Although it may not be possible to adequately describe all the factors to be assessed during the on-site visit, some of the common ones are the following:

(i) Outcome of the education provided;
(ii) Quality assurance processes, including internal reviews;
(iii) Assessment;
(iv) Activities and work of the students;
(v) Entry standards and selection for admission of students;
(vi) Motivation and enthusiasm of faculty;
(vii) Qualifications and activities of faculty members;
(viii) Facilities;
(ix) Industry participation.

7.2 In order to assist the Evaluation Team in its assessment, the educational institution should arrange for the following:

(i) discussions with:
   a) the Dean and Heads of Departments;
   b) a member of the senior administration/management (to discuss how the programme fits into the overall strategic direction and focus of the university, and management support for continued resourcing and development of the programme);
   c) a group of faculty members;
   d) a group of alumni; and
   e) a group of students;

(ii) availability of the following exhibits:
   a) curriculum vitae of all faculty staff;
   b) evidence that the results of assessment of student learning outcomes are being applied to the review and ongoing improvement of program effectiveness;
   c) list of publications by faculty staff;
   d) sample of teaching materials;
   e) sample examination papers for all subjects;
   f) sample of examination scripts (if available) including at least one excellent, one good and one marginal pass for each examination;
   g) transcripts of immediate past graduates, which should also include those who were given advanced standing, and were on accelerated or part-time programme;
   h) sample project and design reports (excellent, good and marginal pass) by students;
   i) sample student feedback form;
   j) results of other internal or external reviews of the course, department and faculty;
   k) results of quality assurance reviews;
   l) records of employment of graduates;
   m) any other documents that the Evaluation Team may request.

(iii) visits to:
   a) classrooms;
   b) laboratories, especially to those for teaching of undergraduates;
   c) the library; and
   d) the computer centre.

7.3 The Evaluation Team should conduct an exit meetingwith key staff of the educational institution (for example, Head of Department in which the programme is being evaluated) at the end of the on-site visit to present its preliminary findings.

8 FOLLOW-UP ACTION AS A REQUIREMENT FOR ACCREDITATION

8.1 If there are requirements which need follow-up action as a condition for accreditation, EAB will require the educational institution to submit a report after a specified period which could be any duration up to the next accreditation period. The specified period will vary depending on the nature of the requirement, for example, whether follow-up actions could be developed and implemented within a short time frame. EAB may also require follow-up visit to review the actions taken by the educational institution.

9 DISPUTE RESOLUTION

9.1 An educational institution may appeal against refusal to accredit, or submit a complaint. An appeal may include a request for re-consideration or a revisit.

9.2 An appeal involving requests for re-consideration or an immediate revisit must be made in writing to the Honorary Secretary, Council of IES within 30 days after receiving notification of refusal to accredit. The appeal should be accompanied by a report to substantiate the request.

9.3 The Council of IES will appoint an Appeals Committee comprising not less than 3 members who have had experience of accreditation. The Appeals Committee will request EAB to consider the request based on the report submitted by the educational institution and respond with its recommendations within 21 days.

9.4 The Council of IES will consider the findings of the Appeal Committee and arrive at a final decision within 60 days after receipt of the appeal. If the request is denied, the Council of IES will provide the educational institution with reasons for the decision.

9.5 If a revisit is necessary, the Council of IES, in consultation with EAB, will appoint a Re-evaluation Team to carry out the on-site visit.

PART IV
ACCREDITATION CRITERIA

10 GENERAL INFORMATION

10.1 The evaluation process is based on 11 broad criteria developed through a participatory process involving academics from the National University of Singapore (*NUS*) and the Nanyang Technological University (*NTU*), and professional engineers from the Institution of Engineers, Singapore (*IES*), the Professional Engineers Board (*PEB*) and the Association of Consulting Engineers, Singapore (*ACES*). Reference is also made to accreditation criteria adopted by other Washington Accord signatories. Each criterion relates to a major feature of institutional activity and effectiveness. The criteria are formulated in terms of parameters, including quantitative measurements that are designed for maximally objective assessment of each feature.

10.2 An engineering programme to be accredited or re-accredited is expected to satisfy all the criteria during the full term of accreditation. The educational institution should periodically review the strengths and weaknesses of the programme and seek continually to improve on standards and quality, and to address deficiencies if any aspect falls short of the standards set by the accreditation criteria.

10.3 The definition of the terms used in this Part are as follows:

(a) Programme Educational Objectives – Programme educational objectives are broad statements that describe the career and professional accomplishments that the programme is preparing graduates to achieve.

(b) Student Learning Outcomes – Student learning outcomes are narrower statements that describe what students are expected to know and be able to do by the time of graduation. These relate to the skills, knowledge, and behaviours that students acquire in their matriculation through the programme.

(c) Assessment – Assessment is one or more processes that identify, collect, and prepare data to evaluate the achievement of programme educational objectives and student learning outcomes.

(d) Evaluation – Evaluation is one or more processes for interpreting the data and evidence accumulated through assessment practices. Evaluation determines the extent to which programme educational objectives or student learning outcomes are being achieved, and results in decisions and actions to improve the programme.

11 ACCREDITATION CRITERIA

11.1 Criterion 1 – Mission and Programme Educational Objectives

(i) Each engineering programme to be accredited or re-accredited should have:

a) published programme educational objectives that are consistent with the mission of the educational institution as well as criteria 2 to 11 listed below, and
b) a curriculum and teaching processes that lead to the attainment of these objectives.

(ii) The objectives should be assessable and realistic within the context of the committed resources. These objectives are periodically reviewed based on feedback of the programme's various constituencies. For this purpose, there should be in place a process to identify and document relationships with constituencies (who are expected to include students) and their needs which have to be adequately addressed when reviewing the curriculum and processes.

11.2 Criterion 2 – Student Learning Outcomes

(i) Graduate attributes

The programme must demonstrate that students attain the following learning outcomes:

a) apply knowledge of mathematics, science and engineering to the solution of complex engineering problems;
b) design and conduct experiments, analyse, interpret data and synthesise valid conclusions;
c) design a system, component, or process, and synthesise solutions to achieve desired needs;
d) identify, formulate, research through relevant literature review, and solve engineering problems reaching substantiated conclusions;
e) use the techniques, skills, and modern engineering tools necessary for engineering practice with appropriate considerations for public health and safety, cultural, societal, and environmental constraints;
f) communicate effectively;
g) recognize the need for, and have the ability to engage in life-long learning;
h) understand the impact of engineering solutions in a societal context and to be able to respond effectively to the needs for sustainable development;
i) function effectively within multi-disciplinary teams and understand the fundamental precepts of effective project management;
j) understand professional, ethical and moral responsibility.

(ii) In addition to incorporating the graduate attributes (a) to (j) listed above as the student learning outcomes, the educational institution may also include any additional outcomes that it wishes to articulate.

(iii) Outcome-base assessment and continuous improvement

The educational institution should show that it has commenced or is committed to put in place appropriate assessment and evaluation mechanisms to demonstrate the achievement of student learning outcomes. For accreditation

visits carried out on or after academic year 2009, the educational institution must provide evidence to demonstrate that its graduates have attained the attributes to a substantial degree. For accreditation visits carried out on or after academic year 2012, the educational institution has to put in place mechanisms for assuring and improving its quality to demonstrate the continual improvement process.

11.3 Criterion 3 – Curriculum and Teaching Processes

(i) Each programme should cover general and specialised professional content of adequate breadth and depth, and should include appropriate components in the Sciences and Humanities.

(ii) The programme must employ effective teaching-learning processes. The modes of teaching used, such as lecture, tutorial, seminar, teacher-student interaction outside class, peer-group discussion, or a combination of two or more of these, must be designed and implemented so as to facilitate and encourage learning. Practical skills, such as the ability to operate computers and other technologically advanced machinery, must be developed through hands-on laboratory work.

(iii) The effectiveness of the teaching-learning processes must be evaluated on a regular basis. The evaluation, besides reviewing the abovementioned factors, must also look at whether the academic calendar, the number of instructional days and contact hours per week, are maximally conducive to teaching and learning. Student feedback on various aspects of the process must be carefully considered as well. Internal reviews of quality assurance procedures should be carried out periodically.

(iv) The educational institution must have a comprehensive and up-to-date library and extensive educational technology facilities.

11.4 Criterion 4 – Students

(i) Students admitted to the programme must be of a quality that will enable them to achieve the learning outcomes. The policies and procedures for student admission and transfer, and for exemptions of courses taken for credits earned elsewhere, should be clearly spelt out and transparent.

(ii) Graduates must be capable of satisfactory performance. The educational institution should monitor its students carefully, and frequently evaluate them, so as to continually assess how successful the programme is in achieving its objectives, and to make improvements accordingly. The requirements of the programme should be made known to every student.

(iii) The educational institution must provide student support services including counselling.

11.5 Criterion 5 – Faculty Members

(i) The faculty members should possess the expertise to cover all the curricular areas of the programme.

(ii) There must be a large enough pool of faculty to enable members to engage in activities outside their teaching duties, especially for the purposes of professional development and interaction with industrial and professional practitioners.

(iii) The number of faculty members must be sufficiently large in proportion to the number of students, so as to provide adequate levels of faculty-student interaction. In any educational programme, it is essential to have adequate levels of teacher-student interaction, which is only possible if there are enough teachers, or in this case, faculty members.

(iv) The authority to steer and run the programme must be in the hands of members of the faculty. This includes the authority over evaluation and assessment processes and decisions on programme involvement.

(v) The faculty must have excellent educational qualifications, and while all of them must be actively pursuing knowledge in their respective areas of interest, at least some of them must have attained international recognition in scholarship in the field. Members of the faculty must possess engineering experience and be from diverse backgrounds. In terms of teaching, the faculty must possess experience, be able to communicate effectively, and be enthusiastic about programme improvement. For courses relating to design, the faculty members in charge of the course must have design experience, and either participate in professional societies or have obtained Professional Engineering registration, where applicable.

11.6 Criterion 6 – Facilities and Learning Environment

(i) Classrooms, laboratories and other teaching facilities must be adequately furnished to provide a learning environment conducive to the fulfilment of programme objectives. Computing and information technology support systems must be in place to support the scholarly activities of both faculty and students.

11.7 Criterion 7 – Institutional Support and Financial Resources

(i) The programme must possess the financial resources necessary to fulfill its mission. In particular, there must be sufficient resources to attract and retain a well-qualified staff, and to provide them with opportunities for continued development and career growth. The programme's budgetary planning process must also provide for the acquisition, repair, maintenance and replacement of physical facilities and equipment.

11.8 Criterion 8 – Governance

(i) The governance structure of the programme must clearly assign authority and responsibility for the formulation and implementation of policies that enable the programme to fulfill its mission.

11.9 Criterion 9 – Interaction between Educational Institution and Industry

(i) There must be industry participation in the development of the curriculum to ensure it is relevant, regularly updated, and meets the needs of the industry, particularly in areas experiencing rapid changes.

(ii) The programme should provide students the opportunity to acquire industrial experience via internships or design projects conducted by professional engineers and faculty members with industrial experience. Where industrial attachment is a requirement, there should be an industrial attachment unit to facilitate this aspect of the programme.

(iii) There must be in place a form of communication channel between the educational institution and the industry, especially so that the industry could give feedback to the faculty concerning the quality of the teaching-learning process and the relevance of the curriculum content to the global market place.

11.10 Criterion 10 – Research and Development

(i) The faculty must be actively involved in research and development. The programme must support, encourage and maintain such R&D activities.

(ii) A vibrant research and development culture is important to any academic programme. It provides new knowledge to the curriculum. The student's education is enriched by being part of such a culture, for it cultivates skills and habits for lifelong learning.

11.11 Criterion 11 – Specific Programme Criteria

(i) In addition to the General Criteria, each programme must satisfy a set of criteria specific to it, known as Specific Programme Criteria. The Specific Programme Criteria deal with the requirements for engineering practice particular to the related sub-discipline. The stipulations in the Specific Programme Criteria chiefly concern curricular issues and qualifications of faculty. In the case where there is more than one set of Specific Programme Criteria, a programme must satisfy every set of criteria.

12 SPECIFIC PROGRAMME CRITERIA

12.1 CRITERIA FOR AEROSPACE ENGINEERING PROGRAMME

(i) The curriculum of the Aerospace Engineering Programme must provide adequate theoretical grounding in aerodynamics, propulsion, thin-wall structures, stability and control, and all the relevant engineering sub-disciplines, such that graduates are able to appreciate the operation of flying vehicles and capable of applying engineering principles to service, modify, or design such vehicles. Proficiency in mathematics is needed to establish such theoretical grounding.

(ii) The programme should have good wind tunnel and computational facilities to illustrate how such tools can be utilised efficiently in the design and development of flying vehicles.

12.2 CRITERIA FOR BIOENGINEERING PROGRAMME, AND BIOMEDICAL ENGINEERING PROGRAMME

(i) The curriculum of the Bioengineering Programme and the Biomedical Engineering Programme must provide adequate theoretical grounding in the biological and medical sciences, and all the relevant engineering sub-disciplines, such that graduates are capable of applying engineering principles to biological or biomedical phenomena. Students must be trained to design and develop new biomedical techniques, devices, and instruments for the measurement, analysis, and interpretation of data from living systems. Courses must cover a broad spectrum of life sciences and bioengineering fields like medical imaging, biosensors, bioinstrumentation, biomechanics, controlled drug delivery, and bioinformatics.

12.3 CRITERIA FOR CHEMICAL ENGINEERING PROGRAMME

(i) Graduates of the Chemical Engineering Programme must have acquired sufficient grounding in physical chemistry, organic chemistry, biochemistry, and materials science, so as to have the necessary background knowledge to meet the objectives of the programme.

(ii) Graduates must possess knowledge of mathematics, particularly in the areas of linear and non-linear algebra, ordinary and partial differential equations, and probability and statistics; and be able to apply the relevant concepts in chemical engineering.

(iii) Core requirements for graduation should include courses that give at least a broad understanding and working knowledge of material and energy balances applied to chemical processes, thermodynamics of physical and chemical equilibria, heat, mass and momentum transfer, chemical reaction engineering, separation operations, process dynamics and control, and appropriate modern experimental and computing techniques with proper reference to safety and environmental aspects at all levels.

(iv) Students must participate in a capstone design project that provides a comprehensive experience of large-scale process design involving multiple unit operations. The design project must develop the ability of participants to work in a team, and at the same time give the individual opportunities to excel. Whenever possible, it should seek to enhance the student's ability to solve problems from first principles.

(v) The programme must provide opportunities for extension through offering electives in contemporary technology, as well as economic and human resource issues in industrial management. It would be desirable that the programme contains elements of enhancement, such as by offering opportunities for more in-depth research experience and advanced electives that encourage deeper and creative thinking on open-ended issues.

12.4 CRITERIA FOR CIVIL ENGINEERING PROGRAMME, AND CIVIL AND ENVIRONMENTAL ENGINEERING PROGRAMME

(i) Graduates of the Civil Engineering Programme and the Civil and Environmental Engineering Programme must be proficient in mathematics, and particularly so in differential equations, probability and statistics, and calculus-based physics. They must also be proficient in a minimum of four recognized major civil engineering areas (namely, structural, construction, geotechnical, hydraulics, environmental and transport). They must have the ability to carry out laboratory experiments and design and integrate all the professional components of the curriculum. Finally, they should have an awareness of professional issues such as the procurement of work, materials and specifications, how design and construction professionals interact effectively to execute a project, the importance of professional registration and continuing education and other professional activities.

(ii) For a programme that includes the word "environmental" in its title, graduates must demonstrate proficiency in chemistry and general biology, and introductory level knowledge of environmental issues associated with air, land, and water systems and associated environmental health impacts.

(iii) Faculty members conducting courses on design should have relevant educational qualifications and professional registration. There should be more than one designated member, preferably a core team, to manage the programme.

12.5 CRITERIA FOR COMPUTER ENGINEERING PROGRAMME

(i) Graduates of the Computer Engineering programme must have knowledge of probability and statistics, differential and integral calculus, discrete mathematics, basic sciences, computer science, and engineering sciences for the analysis and design of complex electrical and electronic devices, software, and systems containing hardware and software components.

12.6 CRITERIA FOR COMPUTER SCIENCE PROGRAMME

(i) Graduates of the Computer Science Programme must have knowledge of programming fundamentals and programming languages, algorithms and complexity, computer organization and architecture, digital logic, operating systems, information management (including organization and retrieval of information), net-centric computing, discrete mathematics, probability and statistics. Graduates are expected to integrate theory, practice, and tools for the specification, design, implementation, testing and maintenance of software systems. In addition to this core body of knowledge, electives covering a variety of application domains and contextual issues should be offered.

12.7 CRITERIA FOR ELECTRICAL ENGINEERING PROGRAMME, AND ELECTRICAL AND ELECTRONIC ENGINEERING PROGRAMME

(i) Graduates of the Electrical Engineering Programme and the Electrical and Electronic Engineering Programme must have the knowledge to analyse and design complex electrical and electronic devices, software, and systems containing hardware and software components. The graduates must have a good understanding of the principles and applications of the basic sciences, engineering science and advanced mathematics, including probability and statistics, differential and integral calculus, linear algebra and complex variables.

(ii) Faculty members conducting courses on design should have relevant educational qualifications and professional registration.

12.8 CRITERIA FOR ENGINEERING SCIENCE PROGRAMME

(i) An Engineering Science programme should place greater emphasis on scientific and engineering fundamentals without compromising on engineering design component of the curriculum. It is expected that the content and depth of coverage of science subjects (e.g. mathematics, physics, chemistry, computing, materials science) are somewhat greater than that in a typical disciplinary engineering programme. Science and engineering subjects should be taught in an integrated manner so that the students are able to develop the ability to solve complex multi-disciplinary engineering problems. The programme should include two design project modules providing students with hands-on learning of basic principles. Students should take a major design project, multidisciplinary in nature, incorporating different facets of engineering and an independent research project which preferably requires synthesis of both scientific and engineering knowledge. Provision of opportunities for industrial attachment is encouraged.

12.9 CRITERIA FOR ENVIRONMENTAL ENGINEERING PROGRAMME

(i) Graduates of the Environmental Engineering Programme must possess an understanding of industrial processes and their potential effects on safety, health and the environment, and they must also possess contemporary knowledge of the prevention and the treatment of pollution-producing waste streams, whether in gaseous, liquid or solid phases (e.g. air pollution control, wastewater treatment, solid and hazardous waste management).

(ii) The graduate must have knowledge in physics, chemistry and biology, that have applications in Environmental Engineering, for example, environmental chemistry and microbiology. They must possess a certain level of proficiency in mathematics, especially in algebraic systems, differential equations, probability and statistics. They must also demonstrate a basic knowledge of regional and global environmental issues, and a working knowledge of fluid mechanics and heat transfer, chemical reactions, and separation processes.

(iii) The graduate must participate in a capstone design project thatpromotes team work and problem solving skills, and include process synthesis, equipment design, safety and environmental management, and economic analysis.

(iv) The programme must provide opportunities for research experience and for professional involvement and development. It must offer advanced electives focussed on enhancing students' understanding of sustainable development and contemporary environmental and process technology. The overall course design must also bring about an understanding of the roles and responsibilities of public institutions and private organisations in environmental management and waste management. All of the above diverse criteria reflect the increasingly interdisciplinary nature of environmental engineering and the increasing focus of environmental engineering on waste minimisation and pollution prevention.

12.10 CRITERIA FOR INDUSTRIAL AND SYSTEMS ENGINEERING PROGRAMME

(i) Graduates of the Industrial and Systems Engineering Programme must have the ability to design, develop, implement and innovate integrated systems that include people, materials, information, equipment and energy. The programme must include in-depth instruction to accomplish the integration of systems using appropriate analytical, computational and experimental practices.

12.11 CRITERIA FOR INFORMATION ENGINEERING AND MEDIA PROGRAMME

(i) The curriculum of the Bachelor of Engineering (Information Engineering and Media) programme must provide adequate theoretical grounding in the info-communication (e.g., programming, computer hardware and software, communications and networking, and digital media processing) discipline such that graduates of the programme are capable of analyzing and designing complex systems containing hardware and software components. The

curriculum must also provide students with exposure to the artistic and creative processes of media creation and production.

12.12 CRITERIA FOR MATERIALS ENGINEERING PROGRAMME

(i) Graduates of the Materials Engineering Programme must have the ability to apply principles in the basic sciences, e.g., chemistry and physics, and engineering principles to materials systems such as metals, polymers, and composite materials. They must have an integrated understanding of the scientific and engineering principles underlying the four major elements of the field, namely, structures, properties, processing, and performance related to material systems. They must be able to apply and integrate knowledge from each of the foregoing four elements of the field to solve materials selection and design problems as well as the ability to use experimental, statistical and computational methods consistent with the programme objectives.

12.13 CRITERIA FOR MECHANICAL ENGINEERING PROGRAMME, AND MECHANICAL AND PRODUCTION ENGINEERING PROGRAMME

(i) Graduates of the Mechanical Engineering Programme and Mechanical and Production Engineering Programme must have the ability to apply mathematics, science, mechanics, thermodynamics and fluid mechanics to mechanical, manufacturing, thermal and electro-mechanical systems and processes, as well as to the design and realization of such systems. Graduates should also have the ability to work professionally in one or more of the fields of specialization identified by the programme.

(ii) Faculty members conducting courses on design should have relevant educational qualifications and professional registration.

PART V
REPORT ON ACCREDITATION INFORMATION

13 GENERAL INFORMATION

13.1 The Report on Accreditation Information (or Report in short) provides information that is critical to a thorough on-site assessment of the programme submitted for accreditation by EAB. It is therefore important that the Report addresses the extent to which the programme meets EAB's Accreditation Criteria.

13.2 To prepare the Report, the educational institution should use the Template for Report on Accreditation Information, a copy of which is available from the EAB.

13.3 The Report should be completed and submitted at least eight (8) weeks before the desired accreditation date. Six (6) sets of the Report in hardcopy and one set in softcopy should be submitted and forwarded to:

Secretary,
Engineering Accreditation Board
The Institution of Engineers, Singapore
70 Bukit Tinggi Road
Singapore 289758

PART VI
REVIEW BY EVALUATION TEAM

14 TASKS FOR EVALUATION TEAM

14.1 After members of the Evaluation Team have been appointed, EAB will notify the educational institution of the composition of the Evaluation Team. EAB will advise the educational institution to contact the Secretary of the Evaluation Team to make arrangements for the on-site visit as well as to provide the name and contact number of a person with whom the Secretary could liaise for further information and clarifications, if necessary.

14.2 Members of the Evaluation Team should note that all correspondences between the educational institution and EAB and all reports made in the evaluation process, as well as information as to whether a programme from an educational institution is being considered for accreditation, are to be classified as confidential and should not be released to any unauthorised persons except with written permission from the educational institution.

14.3 In order to maintain impartiality and transparency in the accreditation exercise, members of the Evaluation Team would not participate in any discussion or decision making process that might involve a conflict of interest.

14.4 The Evaluation Team members will carry out a comprehensive review of the documentation provided on the Report on Accreditation Information. If additional information or clarifications on the information furnished by the educational institution is required, members will channel their requests to the Secretary of the Evaluation Team, who will liaise with the contact person of the educational institution to obtain the information needed.

14.5 The Evaluation Team may meet before the on-site visit to discuss its preliminary findings from the documentation.

14.6 The on-site visit will usually be conducted over a period of two days for each programme. Members could refer to paragraph 7 of Part III as a guide on assessment to be carried out during the on-site visit.

14.7 An exit meeting at the end of the on-site visit programme should be conducted, and the Evaluation Team must present its preliminary findings orally to the educational institution.

14.8 In the event that follow-up activities by the educational institution is required (for example, the educational institution may be required to present additional information which needs to be assessed), the Evaluation Team may appoint one of its member to conduct another visit to review the work.

14.9 A draft report should be submitted to the educational institution for correction of matters of fact prior to its issue in the final form. The educational institution would

not have the right to require a change in the report, but may point out any facts that may be wrong or to provide comments.

14.10 A report of the Evaluation Team is expected to be prepared and forwarded to EAB within 4 weeks after the on-site visit.

15 TASKS FOR MEMBERS OF THE EVALUATION TEAM

15.1 Members of the Evaluation Team should refer to "Guide for Accreditation Visit and Report" which provides details on the roles of the various Evaluation Team members and procedures during pre-visit, on-site visit and post-visit. The Guide will be issued separately to members of the Evaluation Team.

PART VII
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