
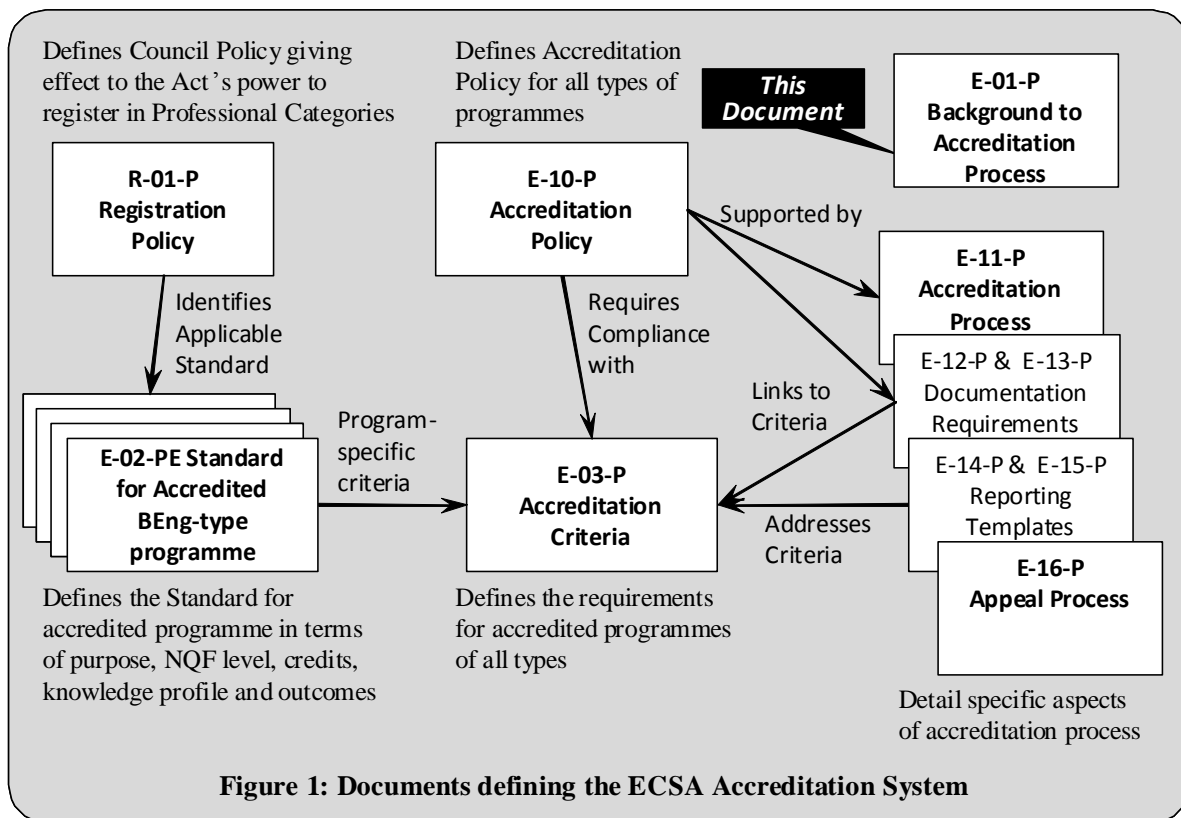


ENGINEERING COUNCIL OF SOUTH AFRICA <i>Standards and Procedures System</i>			 ECSA
Background to Accreditation of Engineering Education Programmes			
Status: Approved by Council			
Document : E-01-P	Rev-2	22 November 2012	

Background: The ECSA Education System Documents

The documents that define the Engineering Council of South Africa (ECSA) system for accreditation of programmes meeting educational requirements for professional categories are shown in Figure 1 which also locates the current document.



1 Purpose

The Engineering Council of South Africa (ECSA) operates a quality assurance system leading to the accreditation of a number of types of engineering education programmes. These programmes are currently the B.Sc.(Eng.)/BEng, BTech and National Diploma programmes, together with new HEQF-compliant qualifications for technology education. The standards, criteria, policies and procedures that define the accreditation system are defined in a set of documents whose structure is described in section 5. This first document in the set provides important background information on the quality assurance and accreditation system.

The process of professional development in engineering is continuous but has important stages. Typically, the first stage is to meet educational requirements, after which employment is entered. During employment, training is completed and experience is gained to attain the competencies for the second stage, namely professional registration. Holding a qualification attached to a programme accredited for the category of registration is one way of meeting the Stage 1 requirements.

Key definitions are given in section 2. Section 3 identifies ECSA's empowerment and obligation to accredit educational programmes. The objectives of accreditation are stated in section 4. Section 5 describes the structure of the documentation system for the accreditation process. Section 6 defines the method of calculating credits for courses and modules and sub-allocating these credits to knowledge areas.

2 Definitions

2.1 General Definitions

Academic Support: a process that provides additional learning support to students who are not prepared for the normal curriculum; academic support may be provided prior to or in addition to the normal curriculum.

Accreditation: is formal recognition awarded to an education or training programme through a quality assurance procedure that it meets criteria laid down for the type of programme.

Accreditation Committee: the Engineering Programme Accreditation Committee (EPAC) or the Technology Programme Accreditation Committee (TPAC) as dictated by the type of programme under consideration or the context.

Accredited Examinations: examinations or other forms of assessment that address the exit level outcomes within an accredited programme.

Accredited Programme: a programme that has been evaluated and recognised by ECSA as meeting stated criteria.

Accredited Qualification: a qualification awarded on successful completion of an accredited programme.

Accreditation criteria: are statements of requirements that must be satisfied by a programme in order to receive accreditation.

Accreditation Visit: an evaluation of an engineering education programme, based on examination of documentation and an on-site inspection to determine the programme's conformance with accreditation criteria.

Assessment: the process of determining the capability or competence of an individual against standards which is carried out by evaluating performances.

Assessment criteria: a set of measurable performance requirements that indicate that a person meets a specified outcome at the required level.

Branch of engineering: a generally-recognised, major subdivision of engineering such as the traditional *disciplines* of Chemical, Civil, or Electrical Engineering, or a cross-disciplinary field of comparable breadth including combinations of engineering fields, for example Mechatronics, and the application of engineering in other fields, for example Bio-Medical Engineering.

Broadly-defined engineering problems: a class of problem with characteristics defined in document E-02-PT.

Category: a mode of registration defined in or under the ECSA Act which has a distinctive purpose, characteristic competencies, defined principal routes to registration and educational requirements.

Complex engineering problems: a class of problem with characteristics defined in document E-02-PE.

Continuous Quality Improvement: a process, based on the concept that improvement of a process is always possible, based on ongoing assessment of the process and measures to maintain and improve quality.

Course: a building block of a programme with defined prerequisites, content and learning objectives with assessment that, if completed successfully, provides credit toward a qualification.

Credit: a measure of the volume of learning attached to a course or module calculated according to the procedure defined in the relevant standard for the type of programme; a level may be associated with a number of credits.

Critical: describes a factor, component, process, issue or decision in an engineering activity from which other consequences follow; an entity or operation that must be successfully implemented or completed to ensure that a more complex operation or system can function: failure of the critical entity or operation compromises the whole.

Education Provider: a public or private higher education institution or body that conducts programmes leading to engineering qualifications of any type accredited by ECSA.

Educational Objective: a statement of the intended achievement that graduates of a programme must be capable of, often with emphasis on the early years after graduation.

Engineering Discipline: synonymous with *branch of engineering*.

Engineering fundamentals: engineering sciences that embody a systematic formulation of engineering concepts and principles based on mathematical and natural sciences to support applications.

Engineering Management: the generic management functions of planning, organising, leading and controlling, applied together with engineering knowledge in contexts including the management of projects, construction, operations, maintenance, quality, risk, change and business.

Engineering Speciality: a generally-recognised practice area or major subdivision within an engineering discipline, for example Structural and Geotechnical Engineering within Civil Engineering.

Engineering Education Programme: an educational programme that aims to satisfy criteria prescribed by ECSA.

Engineering Problem Solving: is the process of finding solutions through a conscious, organised process that relies on the application of engineering knowledge and skills and generic competencies.

Evaluation: determining compliance of a result with prescribed criteria, based on documentation, inspection and the application of judgement supported by reasoning.

Exit-level Outcome: a statement of the learning outcomes the student must demonstrate at the exit level to qualify for award of a qualification; these actions indicate the student's capability to fulfill the educational objectives.

External Moderation: a moderation process in which the moderator(s) are not in the employ of the provider, make no input to the programme and have no prior contact with the students.

Graduate: a qualifying learner, irrespective of whether qualification is a degree or diploma.

Knowledge Area: a classification of curriculum content into defined types. See 2.2 below.

Level: a measure of learning demands in terms of types of problems, knowledge required, skills and responsibility, expressed in terms of level descriptors.

Moderation: is the process of ensuring that assessment of individuals is of the required standard and is consistent, objective and fair.

Module: synonymous with course.

One-higher: applied to a teacher's qualifications, means that the teacher has a relevant academic qualification of at least 120 credits at a level higher than the qualification being taught or is professionally registered in an appropriate category.

Programme: a structured, integrated teaching and learning arrangement with a defined purpose, usually leading to a qualification.

Practice area: *in the educational context:* synonymous with generally-recognised engineering speciality; *at the professional level:* a generally recognised or distinctive area of knowledge and expertise developed by an engineering practitioner by virtue of the path of education, training and experience followed.

Provider: except where the context indicates otherwise, a higher education provider.

Range Statement: contexts in which assessment may take place against an outcome, expressed in terms of situations, activities, tasks, methods, and forms of evidence.

Qualification: the formal recognition of a specified learning achievement, usually awarded on successful completion of a programme.

Stage 1: a point in the process of professional or occupational development in engineering at which a person fulfils the educational requirements to register as a candidate in the relevant category.

Standards: in the context of engineering educational programmes, statements of outcomes to be demonstrated, the level of performance and content baseline requirements.

Sub-discipline: Synonymous with *engineering speciality*.

Well-defined engineering problems: a class of problem with characteristics defined in document E-02-PN.

For generally accepted definitions of other terms see the International Engineering Alliance Glossary at <http://www.ieagrements.org/IEA-Extended-Glossary.pdf>.

2.2 Knowledge Area Definitions

Natural Sciences: physics (including mechanics), chemistry, earth sciences and the biological sciences which focus on understanding the physical world, as applicable in each engineering disciplinary context.

Complementary Studies: cover those disciplines outside of engineering sciences, natural sciences and mathematics which are relevant to the practice of engineering in two ways:

- (a) are essential to the practice of engineering, including but not limited to engineering economics, the impact of technology on society and effective communication; and
- (b) broaden the student's perspective in the humanities, social sciences or other areas to support an understanding of the world.

Computing and Information Technologies: encompasses the use of computers, networking and software to support engineering activity and as an engineering activity in itself as appropriate to the discipline.

Engineering Design and Synthesis: is the systematic process of conceiving and developing materials, components, systems and processes to serve useful purposes. Design may be procedural, creative or open-ended and requires application of engineering sciences, working

under constraints, and taking into account economic, health and safety, social and environmental factors, codes of practice and applicable laws.

Engineering Sciences: have roots in the mathematical and physical sciences, and where applicable, in other natural sciences but extend knowledge and develop models and methods in order to lead to engineering applications and solve engineering problems.

Mathematical Sciences: an umbrella term embracing the techniques of mathematics, numerical analysis, statistics and aspects of computer science cast in an appropriate mathematical formalism.

2.3 Abbreviations

Abbreviations used in the ECSA E-series of documents include the following:

AC:	Advanced Certificate
AD:	Advanced Diploma
BEng:	Bachelor of Engineering
BSc(Eng)	Bachelor of Science in Engineering
BEngTech:	Bachelor of Engineering Technology
BTech:	Bachelor of Technology
CHE:	Council on Higher Education
Dip:	Diploma
ECSA:	Engineering Council of South Africa
ELO:	Exit-level outcome
EPAC:	Engineering Programme Accreditation Committee
HC:	Higher certificate
HEQC:	Higher Education Quality Committee
ND:	National Diploma
NQF:	National Qualifications Framework
SAQA:	South African Qualifications Authority
TPAC:	Technology Programme Accreditation Committee

3 Obligation and Authority to Accredite Engineering Programmes

The Engineering Profession Act, No 46 of 2000 empowers ECSA to conduct accreditation visits to evaluate educational programmes. The Act also determines the maximum interval between such visits. The Act empowers ECSA to grant accreditation, with or without conditions attached, to withdraw accreditation or to refuse accreditation.

Accreditation of a programme signifies that the programme complies with criteria for the educational requirements for registration in a professional category or as a candidate in the corresponding category. Accreditation focuses on programmes; the term *accredited* is not applied by ECSA to a department, school, faculty or education institution.

4 Objectives of Accreditation of Engineering Programmes

The objective of accreditation of engineering programmes is to establish whether a programme meets the accreditation criteria laid down for the type of programme. Accreditation as complying with the criteria:

1. determines whether graduates meet the requirements for registration as a candidate and the educational requirement toward registration as a professional in the relevant category;
2. establishes whether the graduates of a programme are ready to enter engineering employment and are equipped to continue learning throughout their careers;
3. establish the international comparability of engineering educational programmes under agreements to which ECSA is a signatory;
4. assures the public of the quality of the programme;
5. encourages improvement and innovation in engineering education in response to national and global needs.

5 Structure of the Documentation

The structure of the accreditation documentation and relationships among individual documents is shown in Figure 1. The documentation system is modular and has a number of elements described in sections 5.1-5.4. The standards are identified for each category of registration, and hence programme type, by the Registration Policy of the ECSA Council stated in document R-01-P.

The accreditation system follows the general principle that learning outcomes are to be internationally comparable and procedures for accrediting programmes against prescribed standards are to be according to best practice, transparent and fair.

5.1 Accreditation criteria

The accreditation criteria are the set of requirements that indicate that a programme is of adequate quality, including the structure, learning outcomes achieved, educational process and resourcing and sustainability. The accreditation criteria are defined in the following document for all types of programmes. The accreditation criteria make reference to the standards listed in 5.2.

E-03-P: Criteria for Accreditation of Engineering Programmes Meeting Stage 1 Requirements

The accreditation criteria apply to all types of programmes. Specific requirements for each programme type are defined in the standards listed in section 5.2.

5.2 Standards

These documents specify the permitted qualification designations, knowledge profile and exit level outcomes that are incorporated into the accreditation criteria for each type of programme:

E-02-PE: Standard for Accredited BSc(Eng)/BEng Programmes;

E-02-PT: Standard for Accredited Bachelor of Engineering Technology Programmes;

E-02-PN: Standard for Accredited Diploma in Engineering Programmes;

E-05-PT: Standard for Advanced Diploma in Engineering;

E-06-PN: Standard for Advanced Certificate in Engineering;

E-07-PN: Standard for Higher Certificate in Engineering.

The Registration Policy document R-01-P Schedule 2 identifies the engineering educational standard(s) from the above list that are applicable to each professional and candidate categories of registration¹.

¹ A number of these standards are yet to be phased in.

As indicated in 5.1 above, the standards supplement the accreditation criteria. For example, Criterion 2 in document E-03-P requires that defined exit level outcomes be assessed by the provider. Document E-02-PE defines these outcomes for the BEng-type degree.

5.3 Policies and Procedures

The accreditation policies and process are defined in a set of modular documents:

- E-10-P:** Policy on Accreditation of Engineering Programmes Meeting Stage 1 Requirements
- E-11-P:** Procedure for Arranging and Conducting an Accreditation Visit;
- E-12-P:** Documentation Requirements for Accreditation Visits;
- E-13-P:** Forms for Use in Accreditation Visit Documentation;
- E-14-P:** Accreditation Team Report and Recommendation Format;
- E-15-P:** Accreditation Visit Leader's Report Format;
- E-16-P:** Procedure for Appeals against Accreditation Decisions.

5.4 Listings of Accredited Programmes

- E-20-PE:** List of Accredited BEng-type Programmes
- E-20-PT:** List of Accredited BTech Programmes
- E-20-PN:** List of Accredited National Diploma Programmes

5.5 Best Practice and Training Material

The accreditation committees may develop and issue guidance on best practice in accreditation and training material from time to time. This material is informative. The normative documents listed in sections 5.1 to 5.4 take precedence in all cases.

6 Calculation of Credits

The method for calculation of credits (which are currently in an appendix to the BEng, BTech and ND standards) is defined as follows

The method of calculation assumes that certain activities are scheduled on a regular weekly basis while others can only be quantified as a total activity over the duration of a course or module. This calculation makes the following assumptions:

1. Classroom or other scheduled contact activity generates notional hours of the student's own time for each hour of scheduled contact. The total is given by a multiplier applied to the contact time.
2. Two weeks of full-time activity accounts for assessment in a semester.
3. Assigned work is generates only the notional hours judged to be necessary for completion of the work and is not multiplied.

Define for each course or module identified in the rules for the degree:

Type of Activity	Time Unit in Hours	Contact Time Multiplier
L = number of lectures per week	T_L = duration of a lecture period	M_L =total work per lecture period
T = number of tutorial per week	T_T = duration of a tutorial period	M_T =total work per tutorial period
P = total practical periods	T_P = duration of a practical period	M_P =total work per practical period
X = total other contact periods	T_X = duration of other period	M_X =total work per other period
A = total assignment non-contact hours	T_A = 1 hour	

W = number of weeks the course lasts (actual + 2 week per semester for examinations, if applicable to the course or module)

The credit for the course is:

$$C = \{W(LT_L M_L + TT_T M_T) + PT_P M_P + XT_X M_X + AT_A\} / 10$$

The resulting credit for a course or value may be divided between more than one knowledge area. In allocating the credit for a course to multiple knowledge areas, only new knowledge or skills that are explicitly assessed may be counted toward a particular area. Knowledge and skills developed in other courses and used in the course in question shall not be counted. Such knowledge is classified by the nature of the area in which it is applied. In summary, no knowledge is counted more than once as being new.

A spreadsheet is available that supports the calculation of credits and allocation to knowledge areas (Program-Analysis-Worksheet.xls).

Credits for Work-integrated Learning are accrued at a rate of one credit per 30 hours of work or equivalent activity.

7 Revision History

Version	Date	Revision authorised by	Nature of revision
Rev-0:C-A	16 Feb 2006	Working Group	Adapted from PE-60
Rev-0: C-B	21 Feb 2006	Working Group	
Rev-0: C-C	24 July 2006	Working Group	
Rev-0: C-D	24 Aug 2006	Working Group	Minor Editorial changes, Document Number changed
Rev-0: C-E	30 Nov 2006	Working Group	Major editorial revision, new document identifiers inserted
Rev-0: C-F	19 Jan 2007	Working Group	Definitions expanded, document names corrected
Rev-0: Draft A	19 May 2007	EPAC, TPAC	Incorporation of comments and corrections
Rev-0: Draft B	24 Oct 2007		BEng SGG requires additional definitions
Rev-1	7 Feb 2008	EPAC, TPAC, Council	Adopted as Rev-1
Rev-1:Draft A	17 Sept 2008	Technology Qualifications SGG	Added/Improved definitions
Rev-1: Draft B	17 Nov 2008	Technology Qualifications SGG	Section 6 on Credits added
Rev-2:Draft A	25 Oct 2011	EPAC working Group	Definitions and abbreviations added, Cross-references corrected
Rev-2-Draft B	22 Feb 2012	EPAC Working Group	Further definitions added For Public Comment
Rev-2-Draft C	22 June 2012	For approval by and Council	Approved by EPAC and TPAC
Rev 2	22 Nov 2012	Approved by Council	