ENGINEERING COUNCIL OF SOUTH AFRICA *Standards and Procedures System*		
Qualification Standard for Advanced Diploma in Engineering: NQF Level 7		
Status: Approved by Council		
Document : E-05-PT	**Rev 3**	**24 March 2016**

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.

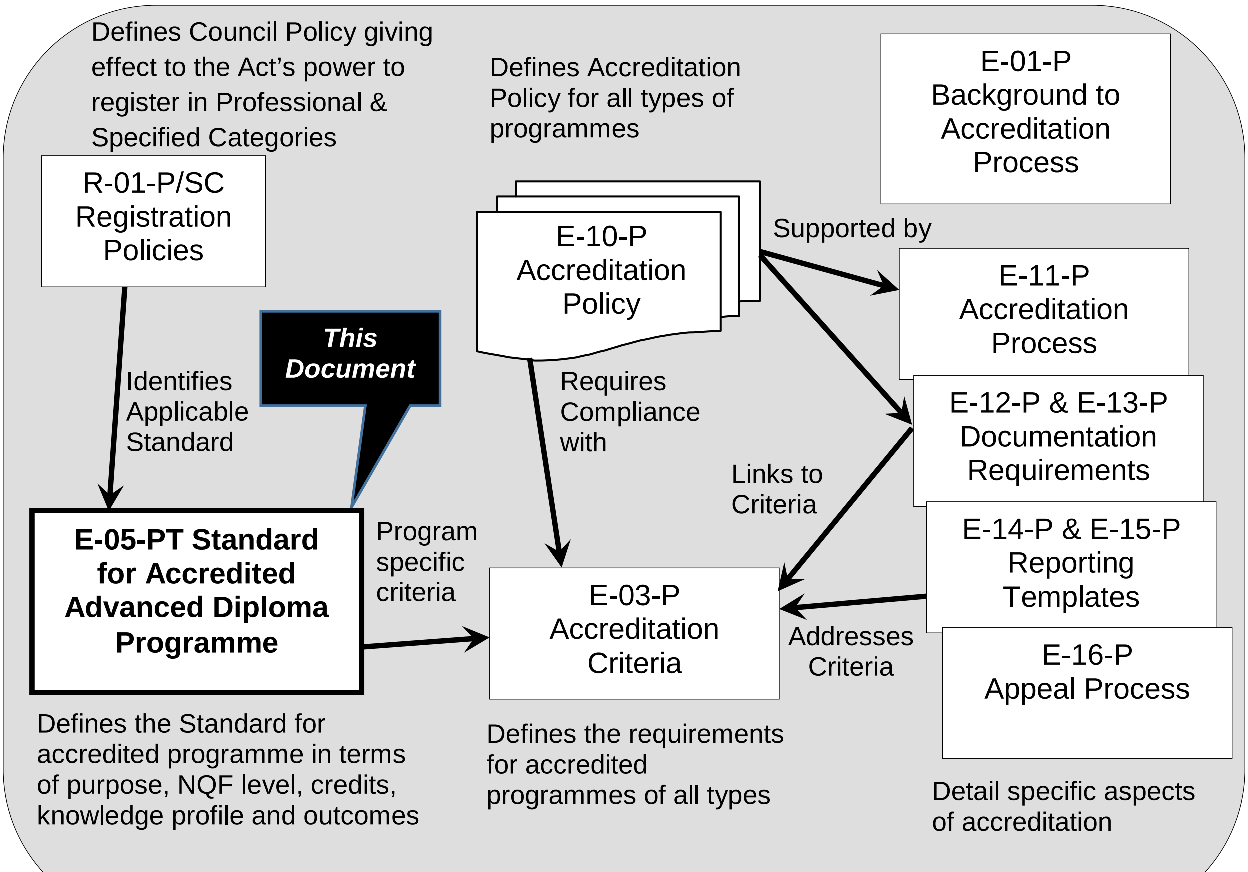

Figure 1: Documents defining the ECSA Accreditation System

Purpose

This document defines the standard for accredited Advanced Diploma in Engineering type programmes in terms of programme design criteria, a knowledge profile and a set of graduate attributes. This standard is referred to in the Accreditation Criteria defined in ECSA document E-03-P.

QUALIFICATION TYPE AND VARIANT

Advanced Diploma in Engineering

GENERAL CHARACTERISITCS

This qualification has a number of different purposes, depending on a student's circumstances and the nature of the programme. It may provide entry-level vocational or professional preparation or specialisation for Bachelor's Degree graduates or diplomates by offering an intensive, focussed and applied specialisation which meets the requirements of a specific niche in the labour market. For example a BSocSci graduate might register for an Advanced Diploma in Human Resource Management in order to enter the field of human resources; a BSc graduate might register for an Advanced Diploma in Education (or PGCE, see exceptions) in order to become a science teacher, or a BSc (Pharm) graduate might register for an Advanced Diploma in Marketing to become a marketing consultant in the pharmaceutical industry. Programmes offering this qualification are therefore particularly suitable for continuing professional development through the inculcation of a deep and systematic understanding of current thinking, practice, theory and methodology in an area of specialisation.

The qualification may also be designed to prepare students for postgraduate study through the deepening of their knowledge and understanding of theories, methodologies and practices in specific academic disciplines and fields, as well as the development of their ability to formulate, undertake and resolve more complex theoretical and practice-related problems and tasks through the selection and use of appropriate methods and techniques.

(The Higher Education Qualifications Sub-Framework, CHE, 2013)

Preamble

The competence of a Professional Engineering Technologist at the level required for independent practice, that is, on qualifying for registration, is generally developed in two stages. First, an Advanced Diploma meeting this standard provides the educational foundation. Second, competence must be further developed through training and experience, typically for three or more years. The educational foundation has an application-oriented theoretical basis of natural sciences and mathematics to underpin practically-oriented engineering science and engineering specialist knowledge, enhanced by some development of engineering science fundamentals and engineering specialist knowledge. Conceptual knowledge is used in engineering applications and design. Optional work-integrated learning provides part of the required practical experience while training and experience after graduation develops contextual knowledge and the ability to solve problems in real-life situations.

As indicated in the qualification title definition, the qualification may be awarded as a result of programmes in one of several disciplines and cross disciplinary fields, including newly emerged fields. This standard specifies the generic knowledge profile and outcomes common to all programmes. Standards are not defined at the second qualifier level.

Note

Words and phrases having specific meaning are defined in Section 11 of this document or in Engineering Council of South Africa (ECSA) Document E-01-P. The method recommended for calculating credits is detailed in ECSA Document E-01-P available at www.ecsa.co.za.

1. HEQSF specification

HEQSF Qualification Type	Advanced Diploma	
Variant	Professionally-oriented	
NQF Exit Level	**Minimum Total Credits**	**Minimum Credits at Exit Level**
7	140	120

2. Qualification title

Designators: Advanced Diploma in Engineering

Qualifiers: The qualifier(s) must contain the word *engineering* and be consistent with the engineering science content of the programme. Disciplinary or cross-disciplinary identifiers include but are not limited to: Agricultural, Aeronautical, Chemical, Civil, Computer, Electrical, Electro-mechanical, Electronic, Environmental, Industrial, Extractive Metallurgical, Information, Materials, Mechanical, Mechatronic, Metallurgical, Mineral(s) Process, Physical Metallurgical and Mining.

3. Purpose statement

This qualification is primarily industry oriented. The knowledge emphasises general principles and application or technology transfer. The qualification provides students with a sound knowledge base in a particular field or discipline and the ability to apply their knowledge and skills to particular career or professional contexts, while equipping them to undertake more specialised and intensive learning. Programmes leading to this qualification tend to have a strong professional or career focus and holders of this qualification are normally prepared to enter a specific niche in the labour market.

Specifically the purpose of educational programmes designed to meet this qualification are to build the necessary knowledge, understanding, abilities and skills required for further learning towards becoming a competent practicing engineering technologist or certificated engineer. This qualification provides:

1. Preparation for careers in engineering itself and areas that potentially benefit from engineering skills, for achieving technological proficiency and to make a contribution to the economy and national development;
2. The educational base required for registration as a Professional Engineering Technologist and/or Certificated Engineer with ECSA. (refer to qualification rules)
3. Entry to NQF level 8 programmes e.g. Honours, Post Graduate Diploma and B Eng Programmes and then to proceed to Masters Programmes.
4. For certificated engineers, this provides the education base for achieving proficiency in mining / factory plant and marine operations and occupational health and safety.

Engineering students completing this qualification will demonstrate competence in all the Graduate Attributes contained in this standard.

Technologist

Professional Engineering Technologists are characterized by the ability to apply established and newly developed engineering technology to solve *broadly- defined* problems, develop components, systems, services and processes.

They provide leadership in the application of technology in safety, health, engineering and commercially effective operations and have well-developed interpersonal skills.

They work independently and responsibly, applying judgement to decisions arising in the application of technology and health and safety considerations to problems and associated risks. Professional Engineering Technologists have a specialized understanding of engineering sciences underlying a deep knowledge of specific technologies together with financial, commercial, legal, social and economic, health, safety and environmental matters.

Certificated Engineer

Professional Certificated Engineers are characterized by the ability to apply established and newly developed engineering technology to solve *broadly-defined* problems, develop components, systems, services and processes in specific areas where a legal appointment is required in terms of either the Occupational Health and Safety Act, the Mines Health and Safety Act, or the Merchant Shipping Act, e.g. factories, mines and marine environments.

They provide leadership in safety, health, engineering and commercially effective operations and have well-developed managerial skills.

They work independently and responsibly, applying judgement to decisions arising in the application of technology and health and safety considerations to problems and associated risks.

Professional Certificated Engineers have a specialized understanding of engineering sciences underlying manufacturing, marine, mining, plant and operations, together with financial, commercial, legal, socio - economic, health, safety and environmental methodologies, procedures and best practices.

4. Normal duration of study

Programmes have a normal duration of one year with not less than 140 Credits, after completion of the Diploma in Engineering or equivalent (total four years with not less than 420 Credits).

5. Standard for the award of the qualification

The *purpose* and *level* of the qualification will have been achieved when the student has demonstrated:

- the knowledge defined in section 6 and
- the skills and applied competence defined in section 7.

6. Knowledge

Knowledge demonstrated by the graduate has the following characteristics:

6.1: At least the number of credits in the knowledge areas shown:

Knowledge area	Minimum Credits
Mathematical Sciences	14
Natural Sciences	7
Engineering Sciences	28
Engineering Design and Synthesis	21
Computing and IT	7
Complementary studies	14

Note: These credits total 91. Credits in selected knowledge areas must be increased to satisfy the 140 minimum total credits

6.2: The level of knowledge of mathematics, natural sciences and engineering sciences is characterized by:

- A knowledge of mathematics using formalism and oriented toward engineering analysis and modelling; fundamental knowledge of natural science: both as relevant to a sub-discipline or recognised practice area;
- A coherent range of fundamental principles in engineering science and technology underlying an engineering sub-discipline or recognised practice;
- A systematic body of established and emerging knowledge in specialist area or recognized practice area; and
- The use of mathematics, natural sciences and engineering sciences, supported by established models, to aid solving *broadly-defined* engineering problems.

6.3: A coherent core of mathematics, natural sciences and engineering fundamentals that provides a viable platform for further studies and lifelong learning. The coherent core must enable development in a traditional discipline or in an emerging field.

6.4: Specialist engineering knowledge at the exit-level. Specialist knowledge may take on many forms including further deepening of a theme in the core, a new sub-discipline, or a specialist topic building on the core. It is recognized that the extent of specialist study is of necessity limited in view of the need to provide a substantial coherent core. Specialist study may take the form of compulsory or elective credits.

6.5: Optional practical knowledge that includes an understanding of workplace practices comprising not less than 30 credits of work-integrated learning.
Should a provider elect to include 30 credits of work integrated learning (WIL) in the programme, the provider must ensure that all students have the opportunity to undertake work-integrated learning.

6.6: In the Complementary Studies area, it covers those disciplines outside of engineering sciences, basic sciences and mathematics which are relevant to the practice of engineering in two ways: (a) principles, results and methods are applied in the practice of engineering, including engineering economics, the impact of technology on society and effective communication; and (b) study broadens the student's perspective in the humanities or social sciences to support an understanding of the world. Underpinning Complementary Studies knowledge of type (b) must be sufficient and appropriate to support the student in satisfying Graduate Attributes 6, 7 and 10 in the graduates specialised practice area.

6.7: This standard does not specify detailed curriculum content. The engineering fundamentals and specialist engineering science content must be consistent with the designation of the degree.

7. Skills and Applied Competence

The graduate is able to demonstrate competence in the graduate attributes 1 to 10. The Graduate Attributes are stated generically and may be assessed in various engineering disciplinary or cross-disciplinary contexts in a provider-based or simulated practice environment. Words and phrases having specific meaning are defined in this document or in the ECSA document E-01-P.

Note:

General Range Statement: The competencies defined in the ten graduate attributes may be demonstrated in a provider-based and / or simulated workplace context.

Graduate Attribute 1: Problem solving

Apply engineering principles to systematically diagnose and solve *broadly-defined* engineering problems

Level Descriptor: *Broadly-Defined engineering problems*:

a. require coherent and detailed engineering knowledge underpinning the technology area;

and one or more of the characteristics:

b. are ill-posed, or under or over specified, requiring identification and interpretation into the technology area;
c. encompass systems within complex engineering systems;
d. belong to families of problems which are solved in well-accepted but innovative ways;

and one or more of the characteristics:

e. can be solved by structured analysis techniques;
f. may be partially outside standards and codes; must provide justification to operate outside;
g. require information from practice area and source interfacing with the practice area that is incomplete;
h. involves a variety of issues which may impose conflicting needs and constraints; technical, engineering and interested or affected parties.

Graduate Attribute 2: Application of scientific and engineering knowledge

Apply knowledge of mathematics, natural science and engineering sciences to defined and applied engineering procedures, processes, systems and methodologies to solve *broadly-defined* engineering problems.

***Range Statement*:** See section 6.2.

Graduate Attribute 3: Engineering Design

Perform procedural and non-procedural design of *broadly defined* components, systems, works, products or processes to meet desired needs normally within applicable standards, codes of practice and legislation.

***Range Statement*:** Design problems used in assessment must conform to the definition of *broadly-defined* engineering problems.

1. A major design project must be used to provide a body of evidence that demonstrates this outcome.
2. The project would be typical of that which the graduate would participate in a typical employment situation shortly after graduation.
3. The selection of components, systems, engineering works, products or processes to be designed is dependent on the sub-discipline.
4. A major design project should include one or more of the following impacts: social, economic, legal, health, safety, and environmental.

Graduate Attribute 4: Investigations, experiments and data analysis

Conduct investigations of *broadly-defined* problems through locating, searching and selecting relevant data from codes, data bases and literature, designing and conducting experiments, analysing and interpreting results to provide valid conclusions.

Range Statement: The balance of investigation and experiment should be appropriate to the discipline. An investigation or experimental study should be typical of those in which the graduate would participate in an employment situation shortly after graduation.

Note: An investigation differs from a design in that the objective is to produce knowledge and understanding of a phenomenon.

Graduate Attribute 5: Engineering methods, skills, tools, including Information Technology

Use appropriate techniques, resources, and modern engineering tools, including information technology, prediction and modelling, for the solution of *broadly-defined* engineering problems, with an understanding of the limitations, restrictions, premises, assumptions and constraints.

Range Statement**:** A range of methods, skills and tools appropriate to the sub-discipline of the program including:

1. Sub-discipline-specific tools, processes or procedures.
2. Computer packages for computation, modelling, simulation, and information handling;
3. Computers and networks and information infra-structures for accessing, processing, managing, and storing information to enhance personal productivity and teamwork;
4. Techniques from economics, management, and health, safety and environmental protection.

Graduate Attribute 6: Professional and Technical Communication

Communicate effectively, both orally and in writing, with engineering audiences and the affected parties.

Range Statement**:** Material to be communicated is in an academic or simulated professional context.

1. Audiences range from engineering peers, related engineering personnel and lay persons. Appropriate academic or professional discourse is used.
2. Written reports range from short (300-1000 words plus tables and diagrams) to long (10 000 to 15 000 words plus tables, diagrams and appendices), covering material at exit level.
3. Methods of providing information include the conventional methods of the discipline, for example engineering drawings, as well as subject-specific methods.

Graduate Attribute 7: Sustainability and Impact of Engineering Activity

Demonstrate knowledge and understanding of the impact of engineering activity on the society, economy, industrial and physical environment, and address issues by analysis and evaluation.

Range Statement**:** The combination of social, workplace (industrial) and physical environmental factors must be appropriate to the sub-discipline of the qualification. Evidence may include case studies typical of the technological practice situations in which the graduate is likely to participate. Issues and impacts to be addressed:

1. Are generally within, but may be partially outside of standards and code of practice
2. Involve several groups of stakeholders with differing and conflicting needs.
3. Have consequences that are locally important but may extend more widely.
4. May be part of, or a system within a wider engineering system.

Graduate Attribute 8: Individual, Team and Multidisciplinary Working

Demonstrate knowledge and understanding of engineering management principles and apply these to one’s own work, as a member and leader in a team and to manage projects.

Range Statement:

1. The ability to manage a project should be demonstrated in the form of the project indicated in attribute 3
2. Tasks are discipline specific and within the technical competence of the graduate.
3. Projects could include: laboratories, business plans, design, etc.;

4. Management principles include:
    4.1 Planning: set objectives, select strategies, implement strategies and review achievement;
    4.2 Organising: set operational model, identify and assign tasks, identify inputs, delegate responsibility and authority;
    4.3 Leading: give directions, set example, communicate, motivate;
    4.4 Controlling: monitor performance, check against standards, identify variations and take remedial action.

Graduate Attribute 9: Independent Learning

Engage in independent and life-long learning through well-developed learning skills.

***Range Statement*:** The learning context is varying and unfamiliar. Some information is drawn from the technological literature.

Graduate Attribute 10: Engineering Professionalism

Comprehend and apply ethical principles and commit to professional ethics, responsibilities and norms of engineering technology practice.

***Range Statement*:** Evidence includes case studies typical of engineering practice situations in which the graduate is likely to participate.

8. Contexts and conditions for assessment

Graduate Attributes defined in 7 above are stated generically and may be assessed in various engineering disciplinary or cross-disciplinary contexts in a provider-based or simulated practice environment.

Providers of programmes shall in the quality assurance process demonstrate that an effective integrated assessment strategy is used. Clearly identified components of assessment must address summative assessment of graduate attributes. Evidence should be derived from major work or multiple instances of limited scale work.

9. Award of the qualification

The qualification may be awarded when the qualification standard has been **met or exceeded**.

10. Progression

Completion of this 140-credit Advanced Diploma is the minimum entry requirement for admission to a Bachelor Honours Degree or Postgraduate Diploma. Entry into these qualifications is usually in the area of specialisation or in the discipline taken as a major in the Advanced Diploma, after completion of the Diploma in Engineering or equivalent. In addition, the graduate attributes are such that a graduate may also meet requirements for entry to a number of programmes including:

1. A candidacy programme toward registration as a Professional Engineering Technologist.
2. In certain disciplines, progression toward the Government Certificate of Competency
3. With appropriate work experience, a Master of Business Administration or similar programme.

11. Guidelines

11.1 Pathway
This qualification lies on a HEQSF Professional Pathway.

11.2 Definition of terms
Complementary Studies: cover those disciplines outside of engineering sciences, natural sciences and mathematics which are relevant to the practice of engineering including but not limited to engineering economics, management, the impact of technology on society, effective communication, and the humanities, social sciences or other areas that support an understanding of the world in which engineering is practised.

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 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 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 Discipline (=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.

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

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.

Engineering Speciality: the extension of engineering fundamentals to create theoretical frameworks and bodies of knowledge for engineering practice areas.

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

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.

11.3 International Comparability
This standard is designed to be substantially equivalent to the Sydney Accord Graduate Attributes (see www.ieagreements.org). The Sydney Accord is an agreement for the mutual recognition of engineering programmes that provide the educational foundation for professional engineering technologists. Comparability of the standard achieved in accredited programmes is audited via a six-yearly Sydney Accord review of the Engineering Council of South Africa, the South African signatory to the accord.

ANNEXURE A

NQF LEVEL DESCRIPTORS

The qualification is awarded at **level 7** on the National Qualifications Framework (NQF) and therefore meets the following level descriptors:

a. **Scope of knowledge**, in respect of which a learner is able to demonstrate: integrated knowledge of the central areas of one or more fields, disciplines or practices, including an understanding of and an ability to apply and evaluate the key terms, concepts, facts, principles, rules and theories of that field, discipline or practice; and detailed knowledge of an area or areas of specialisation and how that knowledge relates to other fields, disciplines or practices.
b. **Knowledge literacy**, in respect of which a learner is able to demonstrate an understanding of knowledge as contested and an ability to evaluate types of knowledge and explanations typical within the area of study or practice
c. **Method and procedure**, in respect of which a learner is able to demonstrate: an understanding of a range of methods of enquiry in a field, discipline or practice, and their suitability to specific investigations; and an ability to select and apply a range of methods to resolve problems or introduce change within a practice
d. **Problem solving**, in respect of which a learner is able to demonstrate an ability to identify, analyse, evaluate, critically reflect on and address complex problems, applying evidence-based solutions and theory-driven arguments
e. **Ethics and professional practice**, in respect of which a learner is able to demonstrate an ability to take decisions and act ethically and professionally, and the ability to justify those decisions and actions drawing on appropriate ethical values and approaches, within a supported environment
f. **Accessing, processing and managing information**, in respect of which a learner is able to demonstrate an ability to develop appropriate processes of information gathering for a given context or use; and an ability to independently validate the sources of information and evaluate and manage the information
g. **Producing and communicating information**, in respect of which a learner is able to demonstrate an ability to develop and communicate his or her ideas and opinions in well-formed arguments, using appropriate academic, professional, or occupational discourse
h. **Context and systems**, in respect of which a learner is able to demonstrate an ability to manage processes in unfamiliar and variable contexts, recognising that problem solving is context- and system-bound, and does not occur in isolation
i. **Management of learning**, in respect of which a learner is able to demonstrate an ability to identify, evaluate and address his or her learning needs in a self-directed manner, and to facilitate collaborative learning processes
j. **Accountability**, in respect of which a learner is able to demonstrate an ability to take full responsibility for his or her work, decision-making and use of resources, and limited accountability for the decisions and actions of others in varied or ill-defined contexts

<u>ANNEXURE B</u>: Exemplified Associated Competency Indicators

The competency indicators presented here are typifying, not prescriptive.

Graduate Attribute 1:

1.1 The problem is analysed and defined and criteria are identified for an acceptable solution.
1.2 Relevant information and engineering knowledge and skills are identified for solving the problem.
1.3 Possible approaches are generated and formulated that would lead to a workable solution for the problem.
1.4 Possible solutions are modelled and analysed.
1.5 Possible solutions are evaluated and the best solution is selected.
1.6 The solution is formulated and presented in an appropriate form.

Graduate Attribute 2:

2.1 An appropriate mix of knowledge of mathematics, numerical analysis, statistics, natural science and engineering science at a fundamental level and in a specialist area is brought to bear on the solution of *broadly-defined* engineering problems.
2.2 Theories, principles and laws are used.
2.3 Formal analysis and modelling is performed on engineering materials, components, systems or processes.
2.4 Concepts, ideas and theories are communicated.
2.5 Reasoning about and conceptualising engineering materials, components, systems or processes is performed.
2.6 Uncertainty and risk is handled.
2.7 Work is performed within the boundaries of the practice area.

Graduate Attribute 3:

3.1 The design problem is formulated to satisfy user needs, applicable standards, codes of practice and legislation.
3.2 The design process is planned and managed to focus on important issues and recognises and deals with constraints.
3.3 Knowledge, information and resources are acquired and evaluated in order to apply appropriate principles and design tools to provide a workable solution.
3.4 Design tasks are performed including analysis, quantitative modelling and optimisation of the product, system or process subject to the relevant premises, assumptions, constraints and restrictions.
3.5 Alternatives are evaluated for implementation and a preferred solution is selected based on techno-economic analysis and judgement.
3.6 The selected design is assessed in terms of the social, economic, legal, health, safety, and environmental impact and benefits.
3.7 The design logic and relevant information is communicated in a technical report.

Graduate Attribute 4:

4.1 Investigations and experiments are planned and conducted within an appropriate discipline.
4.2 Available literature is searched and material is critically evaluated for suitability to the investigation.
4.3 Analysis is performed as necessary to the investigation.
4.4 Equipment or software is selected and used as appropriate in the investigations.
4.5 Information is analysed, interpreted and derived from available data.
4.6 Conclusions are drawn from an analysis of all available evidence.
4.7 The purpose, process and outcomes of the investigation are recorded in a technical report.

Graduate Attribute 5:

5.1 The method, skill or tool is assessed for applicability and limitations against the required result.
5.2 The method, skill or tool is applied correctly to achieve the required result.
5.3 Results produced by the method, skill or tool are tested and assessed against required results.
5.4 Computer applications are created, selected and used as required by the discipline

Graduate Attribute 6:

6.1 The structure, style and language of written and oral communication are appropriate for the purpose of the communication and the target audience.
6.2 Graphics used are appropriate and effective in enhancing the meaning of text.
6.3 Visual materials used enhance oral communications.
6.4 Accepted methods are used for providing information to others involved in the engineering activity.
6.5 Oral communication is delivered fluently with the intended meaning being apparent.

Graduate Attribute 7:

7.1 The impact of technology is explained in terms of the benefits and limitations to society.
7.2 The engineering activity is analysed in terms of the impact on occupational and public health and safety.
7.3 The engineering activity is analysed in terms of the impact on the physical environment.
7.4 Personal, social, economic, cultural values and requirements are taken into consideration for those who are affected by the engineering activity.

Graduate Attribute 8:

8.1 The principles of planning, organising, leading and controlling are explained.
8.2 Individual work is carried out effectively, strategically and on time.
8.3 Contributions to team activities, including at disciplinary boundaries, support the output of the team as a whole.
8.4 Functioning as a team leader is demonstrated.
8.5 A design or research project is organised and managed.
8.6 Effective communication is carried out in the context of individual and team work.

Graduate Attribute 9:

9.1 Learning tasks are managed autonomously and ethically, individually and in learning groups.

9.2 Learning undertaken is reflected on and own learning requirements and strategies are determined to suit personal learning style and preferences.

9.3 Relevant information is sourced, organised and evaluated

9.4 Knowledge acquired outside of formal instruction is comprehended and applied.

9.5 Assumptions are challenged critically and new thinking is embraced

Graduate Attribute 10:

10.1 The nature and complexity of ethical dilemmas is described.

10.2 The ethical implications of decisions made are described.

10.3 Ethical reasoning is applied to evaluate engineering solutions.

10.4 Continued competence is maintained through keeping abreast of up-to-date tools and techniques available in the workplace.

10.5 The system of continuing professional development is understood and embraced as an on-going process.

10.6 Responsibility is accepted for consequences stemming from own actions.

10.7 Judgements are made in decision making during problem solving and design.

10.8 Decision making is limited to area of current competence.

Explanatory Notes

In terms of the National Qualifications Framework (NQF) Act, 67 of 2008, the Council on Higher Education (CHE) is the Quality Council (QC) for Higher Education. The CHE is responsible for quality assurance of higher education qualifications.

Part of the implementation of the Higher Education Qualifications Sub-Framework (HEQSF) is the development of qualification standards. Standards development is aligned with the *nested approach* incorporated in the HEQSF. In this approach, the outer layer providing the context for qualification standards are the NQF level descriptors developed by the South African Qualifications Authority (SAQA) in agreement with the relevant QC. One of the functions of the QC (in the case of higher education, the CHE) is to ensure that the NQF level descriptors 'remain current and appropriate'. The development of qualification standards for higher education therefore needs to take the NQF level descriptors, as the outer layer in the *nested approach*, into account. An ancillary function is to ensure that they 'remain current and appropriate' in respect of qualifications awarded by higher education institutions.

A secondary layer for the context in which qualification standards are developed is the HEQSF. This framework specifies the types of qualification that may be awarded and, in some cases, the allowable variants of the qualification type. An example of variants is the provision for two variants of the Master's degree (including the 'professional' variant).

Another example is the distinction, in the Bachelor's degree type, between the 'general' and 'professionally-oriented' variants. The HEQSF also specifies the purpose and characteristics of each qualification type. However, as indicated in the *Framework for Qualification Standards in Higher Education* (CHE, 2013), neither NQF level descriptors nor the HEQSF is intended to address, or indeed capable of addressing, fully the relationship between generic qualification-type purpose and the specific characteristics of that qualification type in a particular field of study. One of the tasks of standards development is to reconcile the broad, generic description of a qualification type according to the HEQSF and the particular characteristics of qualifications awarded in diverse fields of study and disciplines, as defined by various descriptors and qualifiers.

Development of qualification standards is guided by the principles, protocols and methodology outlined in the *Framework*, approved by the Council in March 2013. The focus of a standards statement is the relationship between the purpose of the qualification, the attributes of a graduate that manifest the purpose, and the contexts and conditions for assessment of those attributes. A standard establishes a threshold. However, on the grounds that a standard also plays a developmental role, the statement may include, as appropriate, elaboration of terms specific to the statement, guidelines for achievement of the graduate attributes, and recommendations for above-threshold practice.

Revision History

Version	Date	Revision Authorized by	Nature of revision
Rev1	20 July 2012	Technology SGG Working Group	Reconfiguration of document approved by Council to align with E-02-PE
Rev 2 Draft A	27 November 2015	SGG draft for submission to EPAC and ESGB	Revision 1 converted to new CHE format
Rev 3 Draft A	23 January 2016	Revised SGG draft for submission to the ESGB	Revision 2 revised (in red underlined) and CHE objection against the use of their logo and ECSA using the wrong procedure to register the standard addressed
Rev 3 Draft A	2 March 2016	Amended and Approved by ESGB	Minor Editing. Final submission to Council.
Rev 3	24 March 2016	Approved by Council	No amendments
ECSA CONTROLLED COPY		**Executive: Policy Development and Standards Generation**	John Cato **2016-08-17** Date