POLICY

FOR THE ACCREDITATION OF

TECHNOLOGY PROGRAMMES IN ENGINEERING

Section 2

REQUIREMENTS FOR ACCREDITATION- (WHAT IS ACCREDITATION)

INDEX:

INTRODUCTION

Accreditation of the National Diploma in Engineering and Bachelor of Technology Engineering qualifications by ECSA serves to establish the following:

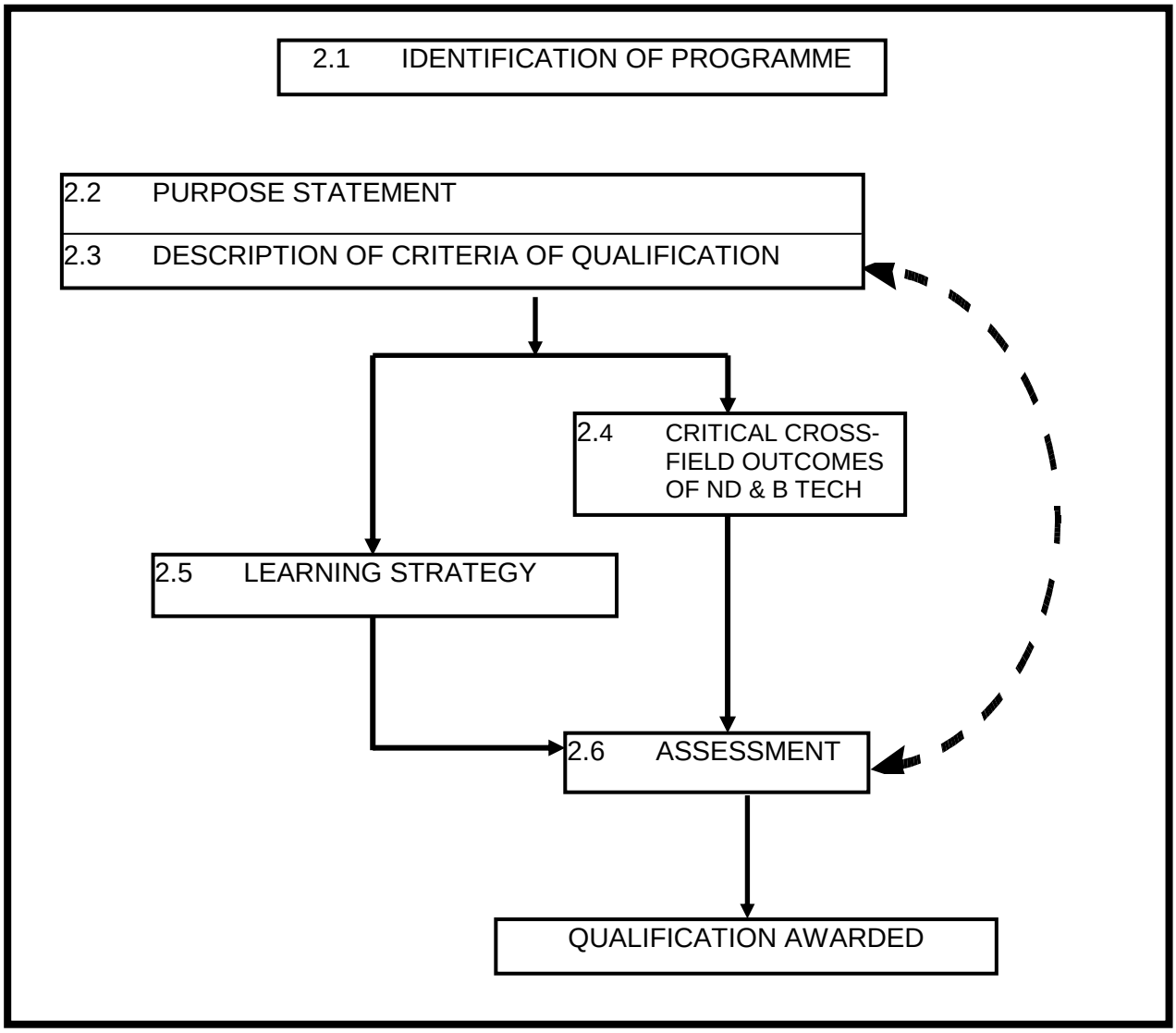
1. Whether the programmes meet the educational requirements toward registration as Professional Engineering Technologists, Professional Certificated Engineers and Professional Engineering Technicians.
2. Whether the graduates from the respective programmes are ready for employment and are equipped to continue learning throughout their careers.
3. To establish the international comparability of the programmes.
4. To assure the public of the quality of the programmes.
5. To encourage improvement and innovation in engineering education in response to national and global needs.

To effectively accredit a programme it is necessary to know the requirements that ECSA considers necessary for the programme. This is necessary as ECSA evaluates the evidence presented by the University of Technology against these requirements.

Education and training is currently undergoing major changes. The criteria that are used are those established previously and are based on the understanding of experienced engineering practitioners of what was provided, what is necessary to do the work of Professional Engineering Technologists, Professional Certificated Engineers and Professional Engineering Technicians and what is required by the industry served. The requirements stated in this section of the guideline are for guidance and must not to be viewed as absolute requirements.

The requirements are classified according to the diagram below. This has been done to assist the various departments of the Universities of Technology in presenting the evidence needed by the assessment teams in an efficient manner. The documentation requested should be available from the submissions to SAQA for registration of existing qualifications and records used in managing the programme.

DIAGRAM 1: DESCRIPTION OF A PROGRAMME
(The numbers in brackets refer to the sections below in which more detail is given)



2.1 IDENTIFICATION OF PROGRAMME

This is required to ensure that all parties can establish the unique identification of each programme. Therefore the University of Technology must ensure that each qualification considered for accreditation has a unique identification and or name.

2.2 PURPOSE STATEMENT

This is a description of the programme. It should include the range statements in which the work of the individuals, on the award of the qualification, are described together with an indication of the working environment in which the work is carried out.

ECSA will use the purpose of the programme as the basis to conduct the assessment.

2.3 DESCRIPTION OF THE CRITERIA OF THE PROGRAMME

2.3.1 General

In this section the outcomes or results that must be obtained to achieve the purpose stated (in 2.2) must be given. Typically they will include but are not limited to:

i. General engineering – identification and analysis of problems, problem solving.
ii. Management and communication – in the working environment of self and others.
iii. Engineering specific to discipline and the target industry.
iv. Application of engineering practice and ethical work practice – including evaluation of ability, competency and work of oneself and of others.

2.3.2 For the National Diploma in Engineering

The learning outcomes must indicate:

i. A basic structure to meet the core requirements/underpinning knowledge of mathematics, science and technology as applied in engineering.

   This includes but is not limited to:

   - Use and interpretation of mathematical formulas used in engineering calculations
   - The ability to performing statistical analyses using standard methods and evaluation
   - Interpretation and evaluation of results
   - Using basic scientific principles in engineering
   - Engineering science applicable to the appropriate sub-discipline

ii. Knowledge that addresses the target industry's specific needs.
iii. Formative education includes critical cross-field outcomes through a co-operative education system in which full integration of *experiential* learning in a real life industrial environment compliments the independent academic, classroom and integrated laboratory work.
iv. Development of manipulative and functional skill.
v. Integration of technological knowledge and skills that develop 'thinking skills' to apply the learning achieved through the programme.
vi. Development of the culture of self-learning and the continuing acquisition of knowledge and skills that are necessary to perform in a developing work environment.
vii. Solving real/industrial problems through the application of current known technology.

2.3.3 For the B. Tech. Engineering Degree

The learning outcomes must indicate:

i. That the qualification is inclusive of a relevant National Diploma in Engineering or proof of equivalent competency. (Deviation from this issue must be addressed during the accreditation.)

ii. That a higher level of proficiency (than that required in the National Diploma) in a particular engineering technology is achieved.

iii. A basic structure to meet the core requirements/underpinning knowledge of mathematics, science and technology as applied in engineering. This includes but is not limited to:
- Use of mathematics to solve technical problems and for modelling
- Support reasoning in technical subjects. Evaluation of results of calculations
- The ability to perform statistical analyses
- Basic science that focuses on the needs of specialist technology area, supports reasoning about engineering phenomena
- Engineering science that focuses on know-how in specialist fields must know how knowledge reacts with related areas and must support interaction with other specialists and generalists.

iv. That technology is transferred for practical purposes. At least 30% of the qualification must be project work involving the solution of real/industrial/applied problems using fundamental principles that underpin current technology.

v. An application of knowledge and skills used in solving complex problems using analytical thinking, technical and managerial skills.

vi. A development of initiatives that leads to the recognition of the need for additional knowledge and skills that will ensure the furthering of technology.

2.4 CRITICAL CROSS-FIELD OUTCOMES APPLICABLE TO THE ND AND B TECH

The following are to be taken into consideration:

i. Identify and solve problems in which responses display that responsible decisions using critical and creative thinking have been made.
ii. Work effectively with others as a member of a team, group, organisation community.
iii. Organise and manage oneself and one's activities responsibly and effectively.
iv. Collect, analyse, organise and critically evaluate information.
v. Communicate effectively using visual, mathematical and/or language skills in the modes of oral and/or written persuasion.
vi. Use science and technology effectively and critically, showing responsibility towards the environment and health of others.
vii. Demonstrate an understanding of the world as a set of related systems by recognising that problem-solving contexts do not exist in isolation.

viii. In order to contribute to the full personal development of each learner and the social and economic development of the society at large, it must be the intention underlying any programme of learning to make an individual aware of the importance of:

- Reflecting on and exploring a variety of strategies to learn more effectively;
- Participating as responsible citizens in the life of local, national and global communities;
- Being culturally and aesthetically sensitive across a range of social contexts;
- Exploring education and career opportunities, and
- Developing entrepreneurial opportunities.

2.5 LEARNING STRATEGY

2.5.1 General

ECSA does not prescribe how learning must take place. However it is expected that:

i. The requirements of a qualification are met through the learning strategy in which various learning methods are used. These methods must be appropriate to the outcomes to be achieved.

ii. Evidence from the various learning methods used will be considered when evaluating how the individual programmes/subjects achieve their purpose. Learning methods that have proved effective in the past and that ECSA expects to be used in the qualifications being assessed include but are not limited to those described in 2.5.2 - 2.5.6.

2.5.2 Academic Education (lecture based supplemented with tutorials, small projects and demonstrations/visits)

Important features include but are not limited to:

i. Addressing components of the programme that are best learnt using this method of learning.

ii. Addressing identifiable components of the programme as described in the criteria including the acquisition of knowledge and skills and the ability to identify problems and to apply knowledge in solving them.

iii. Appropriate entrance requirements/prerequisites.

iv Definite exit criteria/measurable competencies.

v. Problem solving, design and synthesis must follow a logical method and become progressively more complex. (Blooms Taxonomy)

vi. Resources must be adequate to complete the learning specified. The resources include, but are not limited to:

- Lecturers with adequate knowledge, skill and appropriate experience
- Tutors with adequate knowledge, skill and appropriate experience
- Lecture facilities and tutorial rooms, resource centres

vii Provision for maintaining and developing the resources must be adequate. In the case of staff issues include, but are not limited these include:

- Ensuring adequate knowledge
- Ensuring adequate teaching skills
- Ensuring that industrial exposure is current and appropriate for the content taught
- Appropriate work load
- Adequate staff retention and variation
- Continuing professional development

viii. Registration with ECSA is preferable, to determine the level of competence.
ix. Must have effective/adequate and appropriate assessment/evaluation methods (described and applied).
x. Credit/assessment must be appropriate to the type of learning and the effort required/complexity of the learning. (It is expected that credit earned for tests, tutorials and projects is proportional to the effort expended and competency/learning achieved and proven.)
xi. The results achieved should indicate a 'typical' rate of success achieved by the learners.
xii. Student to lecturer ratio should be such that the outcomes are not compromised.

2.5.3 Laboratory Work (hands on experimentation under close supervision using detailed guidelines)

Important features include but are not limited to:

i. Developing manipulative skills needed in the workplace using equipment and instruments currently used in that discipline.
ii. Acquiring knowledge that can be effectively learnt through hands on activities and to consolidate/review learning acquired through academic studies. Where academic and laboratory studies address the same content, it is expected that similar aspects be addressed simultaneously using both methods.
iii. Assessment and credits awarded must be appropriate to the type of learning and the effort required/complexity of the learning.
iv. The combined work of individuals may lead to a group result but the work of each individual must be clearly identified and assessed independently.
v. Adequate resources are available and are used to execute the work specified according to acceptable and safe practice including but not limited to time, equipment and supervision.
vi. Provision for maintaining and developing the resources must be adequate. This includes but is not limited to:

- Ensuring adequate quantities and qualities of appropriate equipment is available
- Ensuring adequate number of technical support staff, teaching staff and supervisory staff and that these staff are competent
- Appropriate work load for the staff

vii. Adequate staff retention and variation.
viii. Assessment and credit awarded must be appropriate to the type of learning and the effort required/complexity of the learning.

2.5.4 Practical Assignments/Projects (learning in which the individual student takes responsibility for own learning)

Important features include but are not limited to:

i. Appropriate project work is desirable in all subjects. It is considered essential in engineering components of each programme.
ii. Students must source and evaluate information using libraries and other resources and/or establish information through experimentation. This is combined with making deductions and forming conclusions and reporting results.

iii. Projects must be more complex at higher levels in the programme. The skills and knowledge acquired during the earlier learning activities must be used in the execution of higher-level projects. This includes the application of mathematics, science, communication and computing in problem solving, design and synthesis in progressively more complex exercises.
iv. Adequate resources are available and are used by the learners for the projects. These include supervision and tuition and guidance, laboratories, libraries and other media sources.
v. Safe and ethical practice is applied during the execution of projects and their evaluation.
vi. Assessment methods and credits awarded must be appropriate to the type of learning and the effort required-complexity of the learning.
vii. The work of each student must be clearly identified and assessed independently specifically where more than one student works on a group project.

2.5.5 Computing

Information technology is a critical tool used in engineering. The scope of using computers should include but need not be limited to:

i. Becoming competent to use common computer applications such as word processing drawing and using spread sheets.
ii. Using of these applications in further studies.
iii. Learning and applying appropriate software in discipline specific activities.
iv. Students must have access to the equipment that is required for the work specified.
v. Provision for maintaining and developing the resources must be adequate.
vi. Tuition and software support must be adequate to ensure that the learning takes place.
vii. Assessment and credit awarded must be appropriate to the type of learning and the effort required/complexity of the learning.

2.5.6 Experiential Learning (National Diploma)

Issues that are considered important for effective experiential learning include but are not limited to:

i. Execution in accordance with appropriate procedures/guidelines. These should indicate the learning outcomes required.
ii. Preparation for professional responsibilities must be included.
iii. Assessment and credits awarded must be appropriate to the type of learning and the effort required/complexity of the learning. This requires a high degree of judgement and appropriate experience. In this regard ECSA expects each mentor evaluator to be a registered person. If a mentor/evaluator is not registered with ECSA evidence of competency to carry out this activity must be available during the assessment inspections.
iv. Experiential training must be of an industrial character. To achieve this, evidence of co-operation with industry is required. Learning in a training 'learning' laboratory/environment is not acceptable. (In exceptional circumstances deviations will be considered by the TPAC provided the contents of paragraph 1.2 are adhered to.) This is necessary as students are expected to gain experience of the discipline involved in industrial employment.
v. Experiential training should include, but is not limited to, work that requires the development, application and use of the knowledge and skills that have been learnt before the experiential training takes place.

vi. Adequate experiential learning in the National Diploma: Engineering programme comprises of:

- A preparatory stage giving the learner an industrial background, which will enable him to relate his/her academic studies to the actual work situation. It must also ensure that the learner becomes familiar with the culture, work ethic, obligations and behaviour expected in the real working environment
- A basic stage developing the manipulative and functional skills required to execute tasks
- An application/project component in which integration of his/her technological knowledge and skills and development of his/her thinking skills will prove that he/she is acquiring the necessary "tools" to start doing productive work in his/her chosen career.

vii. Adequate opportunities for experiential learning must be provided.
viii. Adequate mentors supervisors/tutors and assessors must be provided.
ix. Adequate training of the above people must be provided.
x. Adequate communication assignments as an integrated part of the experiential training must describe the learning achieved as well as the engineering activities undertaken.
xi. The compulsory experiential learning must be completed prior to the commencement of the B Tech engineering qualification.

2.6 ASSESSMENT

2.6.1 Assessment of competency/evaluation of students

As indicated in the subsections above, ECSA expects the assessment procedures to vary depending upon outcomes/achievements being assessed and how the content is being learnt.
The following criteria are important but not necessarily the only criteria used in assessing the assessment of the qualification:

i. It must be carried out according to defined procedure(s).
ii. All the outcomes of the qualification must be assessed.
iii. The allocation of the credits must reflect the learning involved, the complexity of the work assessed and its importance in the course.
iv. The results achieved over a number of years should reflect a success, which will be assessed.
v. Assessments must be accurate measures of the competencies/knowledge and skills achieved.

2.6.2 Entrance Requirements

ECSA supports the development of students who have potential. It is thus necessary to ensure that the students are competent to undertake the subjects of the qualification and achieve the outcomes specified within the time typically allowed. Where applicable, ECSA expects and supports the use of alternative routes to ensure that the competency required for entrance to the programme is achieved. However additional learning activities leading to the entrance requirements are not regarded as part of the minimum duration of the programme leading to the qualification. Therefore such activities will not be considered as part of the programme considered for accreditation.

2.7 DEVELOPMENT OF THE QUALIFICATION

ECSA recognises that engineering qualifications must be developed continuously to ensure that they keep abreast of technology and the requirements of industry and society. This is particularly relevant at present with the current National Developments in Education.

Apart from reviewing the record of developments during the accreditation process, ECSA expects the University of Technology to ensure that ECSA is informed of all changes that will influence a qualification. These include but are not limited to:

- Changes of key staff
- Changes in content
- Change of assessment method
- Change of specifications
- Change of learning method
- Change of Infrastructure