

Discipline Specific Guidelines: Mechanical Engineering

Acceptable Training for Registration as Professional Engineers

It is recommended that Candidate Engineers (Ces) provide a copy of this document to each supervisor of their training and to each of their referees.

1. Introduction

These guidelines are aimed at providing more information about the requirements for registration through the Engineering Council of South Africa (ECSA) in addition to the broader requirements set out in Policy Statement R2/1A.

- 1.1 Candidates wishing to become registered as professional engineers with ECSA must-
 - (i) hold a relevant academic qualification recognised by ECSA through accreditation or evaluation, or pass any examination which ECSA may prescribe; and
 - (ii) demonstrate that they have been trained to an acceptable level of competence in defined elements, in so far as it relates to mechanical engineering, for at least three years; and
 - (iii) display attributes of a professional person.
- 1.2 Immediately upon graduation, candidates are encouraged to apply to ECSA for registration as candidate engineers (CEs), whereafter they will be provided with all relevant documents needed for the complete training period.
- 1.3 The recommended way of achieving the requisite levels of competence in all the training elements is through a focused and collaborative process of acceptable training, where the CEs and their employers (mentors) plan and execute the actual training on the basis of ECSA's Policy Statement R2/1A, as well as the training objectives listed in these Discipline Specific Guidelines.
- 1.4 CEs will be expected to gain practical experience in a position of responsibility and to prove that their education, training, experience and professional development have enabled them to discharge, in full, the responsibilities of a professional engineer in mechanical engineering.

2. Academic Qualifications

- 2.1 The minimum academic qualification required for registration as an CE is an accredited bachelor's degree in mechanical engineering obtained from a South African university.

The list of South African bachelor degrees in mechanical engineering, accredited by ECSA, may be obtained from the Education Department of ECSA, either telephonically at:

Tel: (011) 607-9500
Fax: (011) 622-9295
E-mail: engineer@ecsa.co.za
Web: www.ecsa.co.za

or in writing at:

Private Bag X691
Bruma
2026

- 2.2 Persons who have graduated from a university not accredited by ECSA will be assessed individually on merit. If their qualifications are evaluated as being at least equivalent to an accredited South African degree, candidates will be eligible for registration as CEs and could then follow the formal route to registration as professional engineers.
- 2.3 Persons whose qualifications are not accredited or recognised by ECSA may follow an alternative route to meet the academic requirements for registration as CEs. Candidates must apply to ECSA and obtain the necessary information on the procedure to be followed.
- 2.4 Those who meet ECSA's academic requirements should register as CEs without delay. Application forms can be obtained from ECSA. CEs must, from the outset, also obtain copies of the application form for registration as professional engineers.

3. Training and Professional Development under a Commitment and Undertaking (CU), and Mentorship

Commitment and Undertaking (CU)

- 3.1 CEs must persuade their employers to register a Commitment and Undertaking with ECSA, namely that they will structure the training of, and actually train, their CEs, in accordance with the requirements of ECSA's Policy Statement R2/1A as well as the requirements set out in these Discipline Specific Guidelines. Each CU will be allocated a permanent registration number, which should be quoted by all CEs when applying for registration as professional engineers.
- 3.2 Employers must, at the same time, submit the name(s) of a mentor(s) from within the organisation (see § 3.4 below) or, if an internal mentor is not available, the name of an external mentor (see 3.5 below) to guide CEs through the required process of training. A CU will not be registered by ECSA unless the name of at least one mentor (internal or external) is provided.

Mentorship and Supervision

- 3.3 ECSA and the South African Institution of Mechanical Engineers (SAIMechE) will jointly maintain a list of internal and external mentors. A mentor must be registered as a professional engineer. Council will only in exceptional cases consider the listing of experienced and mature professional engineering technologists, professional certificated engineers, or professional engineering technicians, upon application and motivation by the organisation/mentor concerned. These mentors will be deemed not only to be capable of fulfilling their functions in a professional manner but also as being committed to advising and guiding their CEs in their professional development.
- 3.4 It is **STRONGLY RECOMMENDED** that all CEs should have a mentor who is working in the same organisation as the CE (internal mentor).
- 3.5 If an internal mentor is not available, a list of external mentors can be obtained from ECSA or SAIMechE. It will be expected of employers who make use of the services of external mentors to create an environment in which such mentors can feel free to make recommendations in the reasonable knowledge that their recommendations will be given sympathetic consideration.

- 3.6 It will be expected of all mentors to become fully conversant with their functions and responsibilities referred to in Policy Statement R2/1A and guidelines issued by ECSA from time to time, to conduct regular discussions with their CEs and to assess their progress in accordance with the guidelines set out in Policy Statement R2/1A and these Discipline Specific Guidelines. Since the effectiveness of mentors will continuously be monitored, Council will attach much value to the opinion of "the conscientious mentor" as to the registrability (or otherwise) of their CEs.
- 3.7 It is not expected of mentors to take responsibility for the day-to-day supervision and training of CEs. Mentors/employers should do everything in their power to ensure that competent persons, preferably registered with ECSA, are available to oversee this function as supervisors.

4. General

- 4.1 Training reports, which must be updated regularly, form an essential part of the monitoring process, and these reports must be filled in on the correct forms (Forms A2.1 and A2.2) of the application form. These forms are part of the application form, which should be obtained from ECSA as soon as the CEs start their training.
- 4.2 It is a requirement that CEs who are aspiring to become professional engineers should, with the assistance of their mentors, achieve their training objectives by structuring their training in such a way as to cover the various elements of training referred to in Policy Statement R2/1A and these Discipline Specific Guidelines.
- 4.3 The rate at which CEs progress through their training is determined by themselves, their mentors and other factors, such as the state of the economy and availability of training opportunities.
- 4.4 Where CEs, training under a CU decide to change employers, they should ensure that they continue their training under another CU registered by their new employers. CEs should also ensure that their new employers provide mentors to guide them through the remainder of their training period and to take over where the previous mentor ended. It may even be advisable to retain the previous mentor, if this is at all practicable.
- 4.5 Once all the objectives have been achieved to the satisfaction of the mentor, CEs should, in principle be registerable, and could then apply for registration as professional engineers. Depending on the circumstances, CEs may expect to take a minimum of three years to achieve acceptable competence in all the prescribed elements.
- 4.6 Regardless of whether or not CEs train under a CU, it is recommended that they strive to participate in a process of continuing learning. This concept includes continuing education and professional development.
- 4.7 Continuing learning may include attending courses, technical conferences, seminars, symposia, organised site visits, and meetings of professional bodies, and self-study. The process of continuing learning should achieve a balance between technical content and managerial/professional aspects.
- 4.8 The mentors of CEs should, on a consultative basis, suggest suitable continuing learning programmes.
- 4.9 SAIMEchE and educational institutions may be able to assist in advising on courses which are available.

- 4.10 It will be to the advantage of CEs when applying for registration as professional engineers if they can demonstrate their participation in a process of continuing learning.

5. Professional Attributes

The following attributes are considered common to all professional engineers and the requirements for these attributes are designed to ensure that CEs acquire competence with respect to professional responsibility in decision making, engineering judgement, communication and an appreciation of their own professional and working environments.

5.1 Professional Responsibility

CES must ensure that their work reaches a level of responsibility commensurate with that which ECSA would normally expect of a candidate engineer with three years post-graduate experience, both in terms of the type and level of work being performed. This means that responsibility for directing personnel, money and materials must be taken during the execution of a project, or part of a project. When applying for registration as a professional engineer, CEs must demonstrate their ability to work satisfactorily on their own, that they have taken responsibility and, in having done so, achieved a satisfactory outcome.

5.2 Engineering judgement displayed in practical application

When applying for registration as professional engineers, CEs must demonstrate that their engineering work required them to –

- exercise independent technical judgement, combining their experience and application of engineering principles;
- accept responsibility for such decisions; and
- understand and take into account financial, economic, commercial and statutory considerations.

5.3 Communication Skills

CEs must develop the ability to communicate lucidly, accurately and with confidence. ECSA will base its assessment of a CE's communication skills on the quality of the application presented.

5.4 Professional Environment

CEs must, when reporting to their mentors on a regular basis, and in discussions with them, demonstrate that they have:

- a general understanding of engineering procedures applicable to their discipline of engineering;
- a general knowledge of legislation which has a bearing on the practice of engineering in South Africa, with a detailed knowledge of the important sections of the Engineering Profession Act, 2000 (Act 46 of 2000) and the Acts and Regulations applicable to their specific discipline of engineering;
- an understanding of the Code of Professional Conduct applicable to registered persons;
- an understanding of the purpose of and relationship between the various organisations involved in their discipline of engineering; and
- full familiarity with the requirements for registration set out in Policy Statement R2/1A as well as these Discipline Specific Guidelines.

6. Discipline Specific Elements

Since the field of employment for graduate mechanical engineers cover a wide spectrum, it is not expected that all training programs will be alike. Candidates must be able to prove that they are fully conversant with work performed by other members of the engineering team, they expect to lead. The following elements must have been covered by the candidate mechanical engineer before applying for registration as professional engineers:

6.1 Basic Training

In order to be able to take effective control of manufacturing, maintenance, operational or design functions, applicants must show evidence of practical experience after graduation of one or more of the functions leading to the outcomes listed below. The requirement for Basic Training stems from the need to understand how things are made, altered, constructed or operated before an engineer can reasonably be expected to execute or assume responsibility for the professional engineering function. In addition to the knowledge gained in terms of work processes at shop floor and / or operational level it is important for the engineer to understand the underlying sociological aspects of engineering in the work situation.

The following are considered outcomes resulting from Basic Training and one or more aspects must be included.

- The engineer must understand the technical requirements of the various material forming and manufacturing techniques.
- The engineer must understand how maintenance on plant and equipment is carried out. This would include the physical aspects of maintenance such as disassembly, removal, refurbishing and re-assembly as well as for instance the use of maintenance management systems.
- The engineer must understand the requirements and effective implementation of the principles of plant operation and / or plant commissioning.

The following are not considered valid Basic Training for the purpose of registration through ECSA, although ECSA is mindful that these aspects of the training are important for the trainee's employer and will complement ECSA's requirements.

- Training with the aim to learn company procedures, practices and systems and the like.
- Training to familiarize the trainee with the company's employed technologies, manufacturing processes, installed equipment and the like.

An important outcome of this training period is to be able to distinguish between safe and unsafe work practices as well as between good and poor engineering practices.

This training period should last at least six months and may include attendance of practical courses.

6.2 Design

Design is the core of mechanical engineering. Applicants must show evidence of adequate training in this function through verifiable work carried out in the analysis of problems and the synthesis of solutions. Evidence is required in the form of a report (of approximately 10 to 15 pages) certified by the supervisor. This report should describe a sufficiently complex design to demonstrate that applicants have had an opportunity to apply their technical knowledge and engineering judgement

gained through academic training and practical experience in the design process, at a sufficiently advanced level.

The following are considered the expected outcomes resulting from the training and must include the following:

- The engineer must, in applying technical and scientific knowledge gained through academic training and its application have carried out all or some of the following

- Complete designs of a sufficiently complex nature:

Examples of acceptable designs would include, but are not limited to the design of

- complex fluid systems which includes rotating or reciprocating machines, such as pumps, compressors and blowers.
- complex machines/equipment or major parts thereof.
- complex energy systems involving heat transfer.
- complex pressure systems/HVAC systems.
- complex structures.

If designs are carried out using commercial computer programs the candidate engineer must demonstrate his or her understanding of the underlying assumptions of such programs as well as the theory behind program development.

Examples of designs which are considered not sufficiently complex are the standard design of

- pressure vessels, tanks, containers and the like.
- simple structures such as supports and the like.
- common air-conditioning, ventilation, or piping systems using commercial software.
- stress analysis of components using commercial software without proper interpretation and recommendations.

- Design review of sufficiently complex design:

Acceptable complex design reviews would include reviews of major machine systems such as turbines/compressors with their auxiliary systems, power station systems and their major components, complex refrigeration systems and the like.

- Problem solving:

This would mostly deal with investigating failure or underperformance of major equipment or systems and the synthesis of implemented and proven solutions to avoid recurrence of the problem.

- The engineer must, in carrying out the above, apply professional engineering judgement to all work he or she does. This would include, but would not be limited to, the ability to assess design work against the following criteria:
 - Conformance to specifications, design codes, and health and safety regulations.
 - Ease of fabrication and assembly.
 - Constructability.
 - Maintainability.
 - Conformance to environmental requirements.
 - Ergonomic considerations.
 - Life cycle costs.
 - Alternative solutions.

6.3 Management

The work of an engineer includes the integration of technical knowledge with control over manpower and finances and the management of time and materials. It is, therefore, important that the candidate engineer will have had sufficient opportunity to practice these activities.

The following are considered outcomes resulting from this training period.

- The candidate engineer must be able to estimate plan and control the use of resources, such as money, time, manpower and material.
- The candidate engineer must be able to manage human resources and have sufficient knowledge of the Occupational Health and Safety Act to be able to ensure safety at the workplace of human resources under his or her control.
- The candidate engineer must be able to integrate the work of multidisciplinary teams and to communicate clearly and unambiguously with such teams, all levels of management and other contacts.

As they progress through their training period, graduates must be given increasing responsibility for the independent execution of engineering work. CEs must satisfy ECSA that they have been able to deal adequately with such increased responsibility by having taken significant control of tasks.



Summary of Discipline Specific Training: Mechanical Engineers

SURNAME with initials: _____

Please fill in the periods (weeks) which you consider applicable to the discipline specific elements of Mechanical Engineering Training Programmes (see ECSA Discipline Specific Guidelines for Mechanical Engineers). Exclude any periods of full-time postgraduate study or military service which should be given separately. The periods refer to post-degree periods except as shown.

Period numbers must correspond with those given in the Summary of Training/Experience Report (Form A2.1).

Period Number											Total Weeks
Number of weeks spent on Discipline Specific Elements:											
6.1 Basic Training											
6.2 Design											
6.3 Management											
SUBTOTAL											

Full-time post-graduate study, military service and non-qualifying periods					Weeks
Post-graduate study	Date from:		Date from:		
Military service (engineering)	Date from:		Date from:		
Military service (non-engineering)	Date from:		Date from:		
Non-qualifying periods since graduation	Date from:		Date from:		
TOTAL WEEKS EXPERIENCE					

If you have carried out pre-degree basic training e.g. as a technician or artisan, please give the following information:

Qualification obtained:	
Period (months) on basic training:	

Signature Of Applicant: _____

Date: _____