




# ENSURING THE EXPERTISE TO GROW SOUTH AFRICA

## **Discipline Specific Training Guide for Registration as a Professional Engineer, Technologist and Technician in Civil Engineering**

**R-05-CIV-PE/PT/PN**

**Revision No. 0: 17 April 2024**


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## DEFINITIONS

**Applicant:** A person applying to the ECSA for registration in any of the categories according to Section 18 of the Engineering Profession Act, No. 46 of 2000

**Broadly defined engineering problems:** Composed of many inter-related conditions and requiring underpinning methods, procedures, and technical judgement to create a solution within a set of originally broadly defined circumstances

**Commitment and Undertaking (C&U):** An agreement entered into between an employer and the ECSA under which the employer commits to the training of candidates to the standard required for registration in an identified Professional Category. A C&U may be entered into for one or more of the Professional Categories.

**Competency Assessment:** A summative assessment of an applicant's competence against the prescribed standard based on evidence from the applicant's work and other assessments that include a Professional Review.

**Competency Standard:** Statement of competency required for a defined purpose.

**Continuing professional development:** The systematic maintenance, improvement, and broadening of knowledge and skills and the development of personal qualities necessary for the execution of professional and engineering duties throughout the career of an engineering practitioner


**Engineering problem:** A problematic situation that is amenable to analysis and solution using engineering sciences and methods

**Engineering science:** A body of knowledge based on the natural sciences and using mathematical formulation where necessary that extends knowledge and develops models and methods to support its application, to solve problems, and to provide the knowledge base for engineering specialisations

**Ill-posed problem:** A problem whose requirements are not fully defined or may be defined erroneously by the requesting party

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**Integrated performance:** The overall satisfactory outcome of an activity requires several outcomes to be satisfactorily attained; for example, a design will require analysis, synthesis, analysis of impacts, checking of regulatory conformance, and judgement in decisions.

**Level descriptor:** A measure of performance demands at which outcomes must be demonstrated.

**Mentor:** A professionally registered person who guides the competency development of an applicant in an appropriate category

**Outcome:** At the *professional* level, outcome means a statement of the performance that a person must demonstrate to be judged competent.

**Practise area:** 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


**Range statement:** The required extent of or limitations on expected performance stated in terms of situations and circumstances in which outcomes are to be demonstrated.

**Supervisor:** A person who oversees and controls engineering work performed by an applicant

**Well-defined engineering problems:** Problems composed of inter-related conditions and requiring underpinning methods, procedures, and techniques to create a solution within a set of originally well-defined circumstances.

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## ABBREVIATIONS

<b>BEng (Tech)</b>	Bachelor of Engineering in Technology
<b>BIFSA</b>	Building Industries Federation South Africa
<b>BSc (Eng)</b>	Bachelor of Science in Engineering
<b>BTech (Eng)</b>	Bachelor of Technology in Engineering
<b>CIDB</b>	Construction Industry Development Board
<b>CESA</b>	Consulting Engineers South Africa
<b>CPD</b>	Continuing Professional Development
<b>C&amp;U</b>	Commitment and Undertaking
<b>DoR</b>	Degree of responsibility
<b>DSTG</b>	Discipline-Specific Training Guide
<b>IDoEW</b>	Identification of Engineering Work
<b>IPD</b>	Initial Professional Development
<b>NDip</b>	National Diploma
<b>PD</b>	Professional Development
<b>PE</b>	Professional Engineer
<b>PGDip</b>	Postgraduate Diploma
<b>PN</b>	Professional Engineering Technician
<b>PT</b>	Professional Engineering Technologist
<b>SAFCEC</b>	South African Federation of Civil Engineering Contractors
<b>SAICE</b>	South African Institution of Civil Engineering
<b>SOEs</b>	State-owned enterprises
<b>TER</b>	Training and Experience Report
<b>TES</b>	Training and Experience Summary

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## INTRODUCTION

All persons applying for registration as a Professional Engineer, Technologist and Technicians are expected to demonstrate the competencies specified in document **R-02-STA-PE/PT/PN** through work performed at the prescribed level of responsibility, irrespective of the candidate's discipline.


Training and Mentoring Guide for Professional Categories (document **R-04-T&M-GUIDE-PC**) provides key aspects of training, which are:

- duration of training and length of time working at level required for registration
- principles of planning, training and experience
- progression of training programme
- documenting training and experience
- demonstrating responsibility.

It is therefore important to standardise and provide the framework for all engineering disciplines and registration categories recognised by ECSA.

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## BACKGROUND

The illustration below defines the documents that comprise the Engineering Council of South Africa (ECSA) system for registration in professional categories. The illustration also locates the current document.

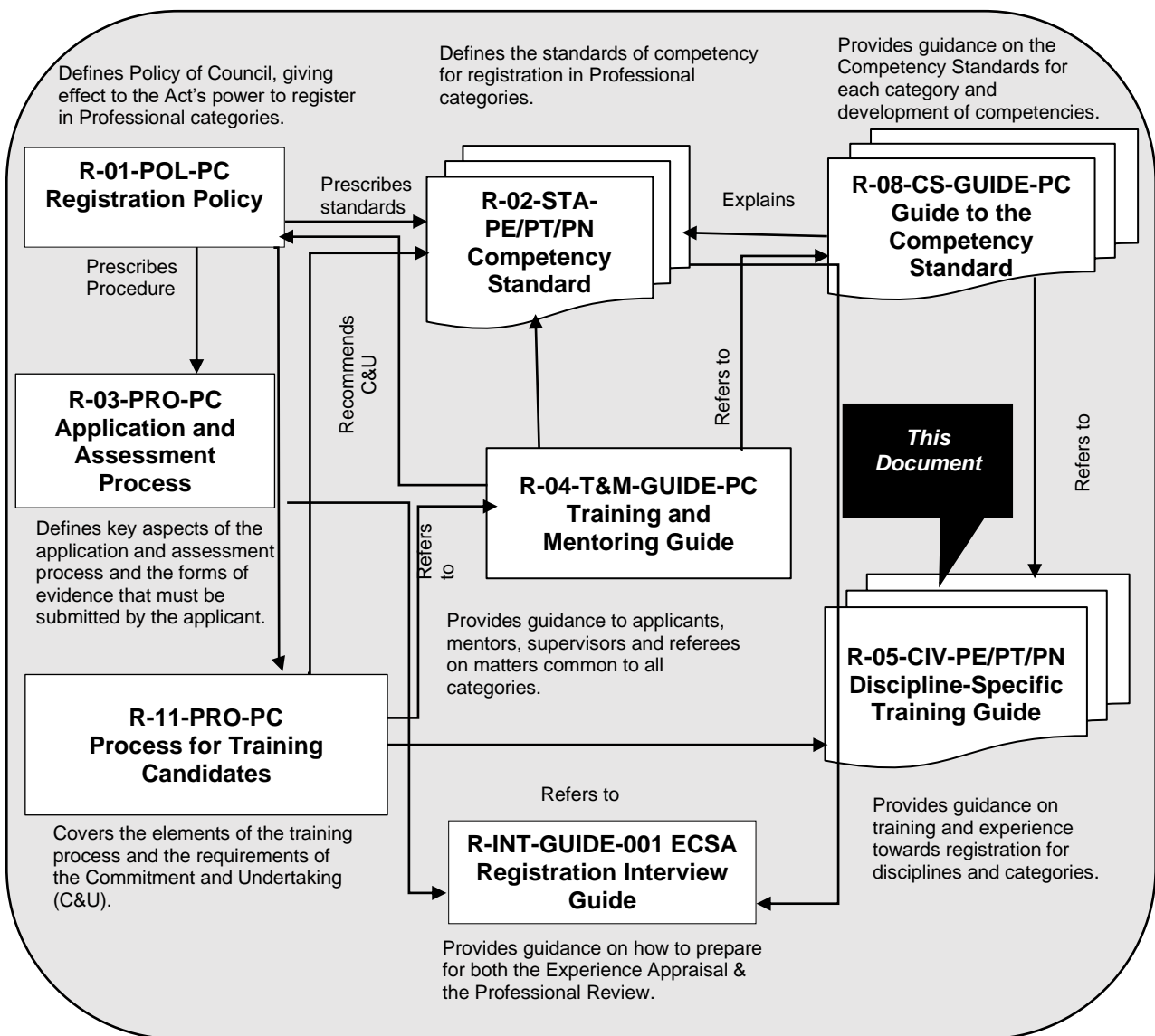



Figure 1: Documents defining the ECSA registration system

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## 1. PURPOSE OF THIS DOCUMENT

This document provides a discipline-specific training guideline, outcome-by-outcome, for applicant Civil Engineers, Technologists and Technicians or any other person who intends to register as a Professional with ECSA in the respective discipline.

This document must be read in conjunction with the following:

- Policy on Registration in Professional Categories (document **R-01-POL-PC**)
- Processing of Applications for Registration of Candidates and Professionals (document **R-03-PRO-PC**).
- Training and Mentoring Guide for Professional Categories (document **R-04-TM-GUIDE-PC**)

## 2. AUDIENCE


The Discipline-specific Training Guide (DSTG) is directed towards applicants, including their supervisors and mentors in the discipline of Civil Engineering. The guide is intended to support the applicants training programme in gaining experience through incorporating elements of good practice also indicated in the **R-02-COP-CIV**: Code of Practice for the Performance of Civil Engineering Work.

The guide applies to persons who:

- (a) have registered with ECSA as a Candidate Engineer, Technologist or Technician
- (b) hold an ECSA accredited qualification or acceptable combination of accredited qualifications prescribed for the category
- (c) through ECSA educational qualification evaluation or assessment, have met the minimum educational in a specific category
- (d) have qualifications recognised by the Washington, Sidney and Dublin Accords where ECSA is a signatory thereof
- (e) hold a qualification or combination of qualifications recognised under an international academic agreement relevant to the category; or

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(f) hold a qualification or combination of qualifications that have been determined on a case-by-case evaluation to satisfy criteria for substantial equivalence to an accredited qualification for the category by virtue of:

- the qualifications being awarded in a jurisdiction or a quality assurance system by ECSA; or
- examination of detailed documentation on the qualifications reflecting substantial equivalence.

## 2.1 Persons registered with ECSA as a candidate

Candidate engineering practitioner refers to persons registered with ECSA after completing the relevant engineering undergraduate programme accredited or substantially assessed to be equivalent by ECSA. The training and development can be done under a Commitment & Undertaking (C&U) candidacy programme as per document **R-11-PRO-PC** or through the training academies programme as outlined in document **A-01-POL**.

The training under C&U or training academies is structured to align with the ECSA standard competency outcomes for the benefit of the candidate. The professional mentor, supervisors, coach and the candidate must ensure that the training covers all developmental aspects aligned with the competency outcomes required for registration as a professional.


## 2.2 Persons not registered with ECSA as a candidate

Regardless of the training development path followed by any individual, all persons wishing to register with ECSA must present the same evidence of having met the ECSA-prescribed competency standard when assessed. Application for registration as a professional in a specific category is accepted without being registered as a candidate Engineer, Technologist or Technician, or without training through a C&U candidacy programme or through training academies. However, mentorship and adequate supervision are critical in ensuring effective development towards achieving the competencies required for professional registration.

If the trainee's employer does not offer C&U, the trainee must establish the level of mentorship and supervision the employer is able to provide and in the absence of an internal mentor, the services of an external mentor should be secured. The discipline specific Voluntary Association (VA) recognised

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by ECSA may be consulted to assist the trainee with an external mentor. A mentor must be familiar with of all expected stages of the training development process as well as ECSA's registration requirements.

It should be noted that the DSTG is intended to assist graduates who are still gaining work experience and knowledge towards professional registration. Experienced persons wishing to register as a professional may apply this guide retrospectively to identify possible gaps in their respective training and development.

Document **R-08-CS-GUIDE-PE/PT/PN** adequately describes what is expected of individuals whose formative developments have not followed conventional paths, for example, academics, researchers and specialists.

### 3. TYPE OF ENGINEERING WORK


**Civil Engineers, Technologists and/or Technicians** form a collective group of engineers who plan, design, organise and oversee the construction, operation, maintenance and management of civil engineering infrastructure.

- **Structural systems:** These include buildings, dams, bridges, roads, highways, runways, harbours and railways.
- **Geotechnical systems:** These include township services, earthworks, excavations, soil conservation and geotechnical processes.
- **Transportation systems:** These include the roads, railway, airport runways and all the combination of elements and their interactions, which produce the demand for travel within a given area.
- **Hydraulic engineering systems:** These include water resources and supply, pipelines, canals, water treatment, storm water and drainage, sewer systems, sanitation waste disposal and coastal engineering.

Typical tasks that Civil Engineers, Technologists and/or Technicians may undertake include the following:

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- Conducting research and developing new or improved theories and methods related to civil engineering.
- Advising on and designing infrastructures such as bridges, dams, harbours, roads, airports, stadiums, railways, canals, pipelines, treatment works, waste-disposal and flood-control systems and residential, commercial, industrial and other large buildings.
- Determining and specifying construction methods, materials and quality standards and directing construction work.
- Establishing control systems to ensure efficient functioning of infrastructure as well as safety and environmental protection.
- Organising and directing maintenance and repair of existing civil engineering infrastructure.
- Analysing the behaviour of soil and rock when placed under pressure by proposed structures and designing structural foundations.
- Analysing the stability of structures and testing the behaviour and durability of materials used in their construction.
- Managing finances which involves preparing the budget, control line items in the budget and proper financial control.
- Executing the design elements according to the specifications and approved construction drawings during the construction stage

Practising Civil Engineers, Technologists and/or Technicians generally concentrate in one or more of the following areas:

- Structural Engineering
- Geotechnical Engineering
- Transportation Engineering
- Roads Engineering
- Materials Science Engineering
- Coastal Engineering
- Municipal and Urban Engineering
- Forensic Engineering
- Environmental Engineering
- Construction and Management Engineering

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- Railway Engineering
- Site development and Planning
- Surveying Water Engineering.

More specialised fields may be in Transportation and Urban Planning, Biosystems Engineering, GIS, Coastal or Marine Engineering and Land-use Management.

The standards are differentiated for Professional Engineers, Professional Engineering Technologists and/or Professional Engineering Technicians by the insertion of level descriptors. These level descriptors are defined for the three professional categories in the Competency Standards defined in documents **R-02-STA-PE/PT/PN**. The applicant for registration should be familiar with the requirements of the applicable standards for the category.

#### **4. DEVELOPING ENGINEERING COMPETENCIES: DOCUMENT (R-08-PE/PT/PN)**

Professional Engineers, Professional Engineering Technologists and Professional Engineering Technicians may be employed in both the private and the public sector. Typically, in the private sector, they would be involved in consulting or contracting, or in supplier or manufacturing organisations. Consultants are responsible for planning, designing, documenting and supervising the construction and/or operation of projects on behalf of their clients. Contractors are responsible for project implementation, and activities, including planning, construction, labour, and resource management. Those working in supply or manufacturing companies could be involved in research and development and would be involved in production, supply and quality control.


The public sector is responsible for service delivery and is usually the client, though in some departments, design and construction are also carried out. Professional Engineers, Professional Engineering Technologists and Professional Engineering Technicians are required at all levels of the public sector, including at national, provincial and local government level, state-owned enterprises (SOEs) and public utilities. The public sector largely handles planning, specifying, overseeing implementation, operations and maintenance of infrastructure.

An extension of the public sector includes tertiary academic institutions and research organisations.

Depending on where the candidate is employed, there may be situations where opportunities in-house are insufficiently diverse to develop all the competencies required in both Groups A and B,

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noted in document **R-02-STA-PE/PT/PN**. For example, the opportunity to develop problem-solving competence (including design or developing solutions) and to manage engineering activities (including implementing or constructing solutions) may not both be available to the candidate. In such cases, employers are encouraged to put a secondment system in place.

It has been fairly common practice that where an organisation is unable to provide training in certain areas, secondments are arranged with other organisations, so the candidate is able to develop all the competencies required for registration.

These secondments are usually reciprocal, so both employers and their respective employees get the mutual benefit from the other party. Secondments between consultants and contractors, and between the public and private sector should be possible.

#### **4.1 Training for registration as a Professional Engineer**

##### **4.1.1 Investigation and analysis (Responsibility Level E)**


The definition, investigation and analysis of complex engineering problems is typified by:

- defining the engineering problems and procedures for solving the problems
- investigating and evaluating pertinent information and identifying systems and sub-systems of complex problems, including collecting, organising and evaluating information from all applicable sources including in-situ investigations where appropriate
- analysing relevant assumptions, inputs and required outputs of a complex engineering problem.

To evaluate and analyse the engineering problem the applicants should:

- identifies and formulates the problem, which leads to an agreed definition of the problem to be addressed
- collects, organises and evaluates information
- uses conceptualisation, abstraction and modelling
- identifies and justifies assumptions, limitations, constraints and premises
- uses both mathematical and non-mathematical analytical methods
- evaluates the results of the analysis, using judgement
- expresses understanding of the results emerging from the analysis.

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#### 4.1.2 Engineering design and development of solution (Responsibility Levels C and D)

Designing or developing solutions to complex engineering problems based on engineering knowledge is at the centre of other engineering activities such as planning, research, development and technology transfer, quality assurance, risk analysis, domain-specific project management, managing engineering processes, safe work practices, environmental protection, sustainability analysis and systems engineering.

An example approach for the candidate is given below:

- analyses the requirements for the design/planning/solution and draws up a detailed requirements specification
- synthesises a range of potential solutions to the problem or a range of approaches to developing a solution that is consistent with assumptions, premises, limitations and constraints
- evaluates the potential approaches against the requirements and include cost and impacts outside the requirements
- presents reasoned arguments and a proposal for the preferred option
- fully develops the design of the selected option
- evaluates the resulting solution
- produces design documentation for review and implementation.

#### 4.1.3 Contextual knowledge (Responsibility Level E)


During this stage, applicants demonstrate how they comprehended and applied advanced and local knowledge of the widely applied principles underpinning good practice that are specific to the jurisdiction in which the engineer practices.

The application of engineering knowledge as an outcome is normally demonstrated during design, investigation or operations. The applicant:

- displays mastery in the understanding of engineering principles, practices and technologies in the practice area
- applies general and underpinning engineering knowledge to support analysis and to provide insight

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- uses an analytical approach based on fundamentals and first principles in building models as required
- displays working knowledge of areas that interact with the practice area
- applies related financial, statutory, safety, and management knowledge
- calculates at theoretical level confirming the correct application and utilisation of equipment, materials, and systems
- understands complex procedures and techniques that must be based on fundamental mathematical, scientific, and engineering knowledge, as part of personal contribution within the engineering team
- displays the ability to manage the resources within legal and financial constraints.

#### 4.1.4 Engineering project management (Responsibility Level D)

During this stage, applicants develop competence in managing part or all of one or more complex engineering activities which can be displayed by:


- managing self, people, work priorities, processes, and resources when performing complex engineering activities
- planning, organising, leading and controlling complex engineering activities
- managing contracts and other agreements and the ability to establish and maintain professional and business relationships
- resources management, availability and controlled by a work breakdown structure and scheduling to meet deadlines. Quality, safety and environment management are important aspects
- the basic elements of management must be applied to complex engineering work.

In line with the progression of levels of engineering work and the degree of responsibility (DoR) defined in document **R-04-T&M-GUIDE-PC**, the applicant uses various phases of activities that assist in developing the ability to plan, organise, lead and control. The applicant must be able to perform these functions alone and in a team. Conducting engineering work alone or in a team requires planning and organising to attain the required technical outcomes. Participation and contribution as a team member and as a leader give the opportunity to demonstrate leadership and the ability to control on a limited scale.

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#### 4.1.5 Professional communication (Responsibility Level C)

During this stage, applicants should demonstrate competence in how to communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities. Communication with respect to complex engineering problems relates to the technical aspects and the wider impacts of professional work. The applicant should develop the ability to:

- write clear, concise, and effective technical, legal, and editorially correct documentation
- issue clear and concise instructions and/or guidance, being cognisant of the audience and various skill levels
- execute oral presentations using structure, style, language, visual aids, and supporting documents appropriate to the audience and the purpose.

Moreover, the applicants should display effective communication which can be demonstrated by the ability to write clear, concise, and effective reports that are technically, legally and editorially correct using a structure and style that meets communication objectives and user/audience requirements.

#### 4.1.6 Impact of engineering activities and risk mitigation (Responsibility Level B)

During this stage, applicants demonstrate the ability to recognise the reasonably foreseeable economic, social, cultural, and environmental effects of complex engineering activities, while seeking to achieve sustainability.


Furthermore, the applicants should develop the ability to identify interested and affected parties and their expectations with regard to technical, social, cultural and environmental effects, and be able to put in measures to mitigate the negative effects of complex engineering activities.

The applicants should be allowed to study, analyse, and recommend measures for:

- social/cultural impacts
- community/political considerations
- environmental impact
- sustainability analysis
- regulatory conditions

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- potential ethical dilemmas.

#### 4.1.7 Statutory & regulatory requirements (Responsibility Level E)

During this stage, applicants should develop the ability to meet all legal and regulatory requirements and protect the health and safety of persons during all complex engineering activities. Applicants are expected to have a working knowledge of the following Acts:

- Engineering Profession Act, 46 of 2000, its Rules, specifically the Code of Conduct
- Occupational Health and Safety Act, 85 of 1993 and its relevant regulations pertaining to the industry, as amended by Act 181 of 1993
- Construction Regulations

Moreover, depending on their area of practice, applicants should have a working knowledge of the following Acts but not limited to these Acts:

- National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act 49 of 1995
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Water Services Act, 108 of 1997, as amended by Act 30 of 2004
- National Water Act, 36 of 1998, as amended by Act 45 of 1999.

The candidate is expected to have a basic knowledge of the applicable Acts that are applicable to their area of practice. This list is not exhaustive.


#### 4.1.8 Ethics of Engineering (Responsibility Level E)

During this stage, applicants are expected to conduct engineering activities ethically. The applicants should be capable of handling ethical issues and adopt a systematic approach to resolve ethical issues, which is typified by:

- identifying the central ethical problem
- identifying affected parties and their interests
- searching for possible solutions to the dilemma

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- evaluating each solution using the interests of those involved and according to suitable priorities
- selecting and justifying the solution that most appropriately resolves the dilemma.

The applicants are expected to have knowledge and compliance with the ECSA Code of Conduct for registered persons and be able to identify ethical problems and affected parties, and a systematic approach to resolving the issues while executing complex engineering activity.

#### 4.1.9 Exercising engineering sound judgement (Responsibility Level E)

During this stage, applicants demonstrate the ability to exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of complex engineering activities. Judgement is expected in considering the interactions among conflicting technical, engineering, social or other issues and their far-reaching impact on affected parties in making recommendations.

The indication that a candidate/applicant exhibits engineering judgement is typically demonstrated by the following:

- considering several factors, some of which may be ill-defined or unknown
- considering the interdependence, interactions and relative importance of factors
- foreseeing consequences of actions
- evaluating a situation in the absence of full evidence.
- drawing on experience and knowledge.


#### 4.1.10 Responsibility in decision-making (Responsibility Level E)

During this stage, applicants are responsible for making decisions on part or all of complex engineering activities. Competence in responsible decision-making is typified by:

- systematic gathering of related information and checking of facts and inputs required for the decision-making process
- making the final decision, based on knowledge, past experience and seeking advice on matters falling outside the applicant's education and experience
- recording the decision-making process and the reasons for the final decision

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- taking responsibility and being prepared to be held accountable for far-reaching and significant consequences (whether positive or negative).
- continuous self-evaluation to ascertain that the task given is done correctly, on time and within budget

#### 4.1.11 Professional development (Responsibility Level D)

Professional development involves taking ownership, and independently planning, selecting, undertaking, and recording appropriate activities to extend competence. Applicants undertake sufficient professional development activities to maintain, extend competence, and enhance the ability to adapt to emerging technologies and the ever-changing nature of work. Competence in self-development is typified by:

- explaining awareness and a strategy to independently enhance professional development
- evidence of self-development in chosen and new areas of expertise and personal development
- taking responsibility for one's own development
- reflecting on strengths and weaknesses, recognising needs, and planning
- executing development activities and overcoming obstacles.


### 4.2 Training for registration as a Professional Engineering Technologist

#### 4.2.1 Investigation and analysis (Responsibility Level E)

During this stage, applicants demonstrate how to establish the level of complexity of the initial problem state, the complexity of the problem path from the initial state and the level of decision-making required and potential consequences. The definition, investigation and analysis of broadly defined engineering problems is typified by:

- performing or contributing to defining broadly defined engineering problems, thus leading to an agreed definition of the problems to be solved
- investigating or contributing to investigating engineering problems, including collecting, organising and evaluating information from all applicable sources, including in-situ investigations where appropriate

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- performing or contributing to analysing engineering problems, using conceptualisation, justified assumptions, limitations and evaluation of results.

#### 4.2.2 Engineering design and development of solution (Responsibility Level C and D)

The applicants should develop the ability to apply mathematical, natural science and engineering knowledge while developing solution to a broadly defined engineering problem that is typified by:

- designing or developing solutions to broadly defined engineering problems using appropriate theory and information technologies, while checking impacts, sustainability and stakeholder views
- systematically synthesising solutions and providing alternatives by analysing designs, correlating with requirements and considering the wide-ranging impacts and costs
- creating detailed specification requirements and designing documentation for implementation to the satisfaction of the client.

Furthermore, applicants perform a creative, systematic analysis of problems at the required level and work systematically to synthesise solutions to the problems and be able to:


- propose potential approaches or alternatives to the solution
- conduct a preliminary synthesis following selected approaches
- evaluate potential solutions against requirements and wider impacts
- present reasoned, economical and contextual engineering arguments and justification for the selected option or preferred solution
- fully develop the selected option or preferred solution
- evaluate the resulting solution
- document the solution for approval and implementation.

#### 4.2.3 Contextual knowledge (Responsibility Level E)

During this stage, applicants demonstrate how they comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems and methodologies that is specific to the jurisdiction in which the Engineering Technologist practices. The applicants should

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develop the ability to analyse and model the engineering materials, components, systems or processes at broadly-defined engineering problems which are typified by:

- state what engineering principles, practices, procedures, methodologies and technologies, including the application of the theory, are applied in the practice area
- indicating a working knowledge of areas of practice that interact with the practice area to underpin teamwork
- demonstrating knowledge and application of engineering standards, codes of practice, legislation, regulations, and finance in the practice area.

The candidate/applicant typically demonstrates the following:

- Displays mastery of understanding current and emerging technologies in the practice area.
- Applies general and underpinning engineering knowledge to support analysis and provide insight into technologist activities.
- Uses an analytical approach as required.
- Displays working knowledge of areas that interact with the practice area.
- Applies related financial, statutory, safety, and management knowledge.


#### 4.2.4 Engineering project management (Responsibility Level D)

During this stage, applicants develop the ability to exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of broadly defined engineering activities in line with the Competency Standard, document **R-02-STA-PE/PT/PN**, on the following:

- competency to manage broadly defined engineering activities must be demonstrated
- linked with management is the ability to communicate with those involved in the engineering activities
- managing self, people, work priorities, processes, and resources when performing broadly defined engineering activities
- planning, organising, leading, and controlling broadly defined engineering activities
- managing contracts and other agreements and the ability to establish and maintain professional and business relationships.

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#### 4.2.5 Professional communication (Responsibility Level C)

During this stage, applicants are expected to display effective communication which can be demonstrated by the following personal and the work processes:

- reading and evaluating engineering and legal matter relevant to the function of the Professional Engineering Technologist
- receiving instructions and ensuring correct interpretation
- issuing clear instructions to subordinates using appropriate language and communication aids and ensuring that language and other communication barriers are overcome
- undertaking oral presentations using structure, style, language, visual aids and supporting documents appropriate to the audience and purpose.

#### 4.2.6 Impact of engineering activities and risk mitigation (Responsibility Level B)

The applicants should develop the ability to identify interested and affected parties and their expectations concerning technical, sociocultural, and environmental effects while considering the economics and long-term sustainability of the broadly defined engineering activities and put in measures to mitigate the negative effects. Competence can be demonstrated when the applicants is allowed to study, analyse, and recommend measures for:


- social/cultural impacts
- community/political considerations
- environmental impact
- sustainability analysis
- regulatory conditions
- potential ethical dilemmas.

#### 4.2.7 Statutory and regulatory requirements (Responsibility Level E)

To demonstrate competency in regulatory aspects, the applicants should develop the ability to meet all legal and regulatory requirements, protect the health and safety of persons during all broadly

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defined engineering activities and deal with uncertainty and risk applicable. The applicants should be able to

- identify the applicable legal, regulatory, and health and safety requirements for the engineering activity
- identify the risk and apply defined widely accepted risk management strategies
- select safe and sustainable materials, components, processes and systems
- communicate with parties involved in the legal and regulatory aspects.

Applicants are expected to have a working knowledge of the following Acts:

- Engineering Profession Act, 46 of 2000, its Rules, specifically the Code of Conduct
- Occupational Health and Safety Act, 85 of 1993 and its relevant regulations pertaining to the industry, as amended by Act 181 of 1993
- Construction Regulations.

Moreover, depending on their area of practice, applicants should have a working knowledge of the following Acts, but not limited to these Acts:

- National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act 49 of 1995
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Water Services Act, 108 of 1997, as amended by Act 30 of 2004
- National Water Act, 36 of 1998, as amended by Act 45 of 1999.

The candidate is expected to have a basic knowledge of the applicable Acts that are applicable to their area of practice. This list is not exhaustive.


#### 4.2.8 Ethics of engineering (Responsibility Level E)

The Code of Conduct covers the need to practise ethically and within one's area of competence, work with integrity, respect public interest and the environment, and uphold the dignity of the profession, including one's relationship with fellow professionals. There is also a section on administrative matters that relate to ethical practice. Applicants must study the ECSA Code of Conduct and be aware of its implications in situations that arise in engineering work. Applicants who

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are capable of handling ethical issues adopt a systematic approach to resolve ethical issues, which is typified by:

- identifying the central ethical problem
- identifying affected parties and their interests
- searching for possible solutions to the dilemma
- evaluating each solution using the interests of those involved and according to suitable priorities
- selecting and justifying the solution that most appropriately resolves the dilemma.

#### 4.2.9 Exercising engineering sound judgement (Responsibility Level E)

During this stage, applicants develop the ability to exercise sound judgement by evaluating the outcomes, impacts and alternatives in the course of broadly defined engineering activities. The indication that a candidate/applicant exhibits engineering judgement is typically demonstrated by the following:

- considering several factors, some of which may be ill-defined or unknown
- considering the interdependence, interactions and relative importance of factors
- foreseeing consequences of actions
- evaluating a situation in the absence of full evidence
- drawing on experience and knowledge.


#### 4.2.10 Responsibility in decision-making (Responsibility Level E)

During this stage, applicants are responsible for making decisions on part or all of broadly defined engineering activities and should demonstrate responsibility at the required level of degree of responsibility, which is evidenced by:

- demonstrating a professional approach at all times
- indicating due regard to technical, social, environmental, and sustainable development considerations
- seeking advice from a responsible authority on any matter considered to be outside the area of competence

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- making decisions and taking responsibility regarding work output.

#### 4.2.11 Professional development (Responsibility Level D)

During this stage, applicants undertake sufficient professional development activities to maintain, extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work. The emphasis is on the individual's ability to self-develop. This capability has several dimensions:

- taking responsibility for one's own development
- reflecting on strengths and weaknesses, recognising needs and planning
- executing development activities and overcoming obstacles.

All the activities listed below, including combinations thereof, constitute PD and thus, IPD:

- attending courses, seminars, congresses and technical meetings organised by engineering institutions/institutes, universities, other professional bodies and course providers
- actively participating in conferences, serving on technical or professional committees and engaging in working groups
- undertaking structured self-study (i.e., using textbooks with examples)
- studying technical literature (e.g., journals, magazines)
- taking correspondence courses, studying other supervised study packages, and taking in-house courses provided by employers where applicable
- enrolling for formal postgraduate studies (limited credits)
- Writing technical papers or presenting papers or lectures at organised events.

### 4.3 Training for registration as a Professional Engineering Technician


#### 4.3.1 Investigation and analysis (Responsibility Level E)

The definition, investigation and analysis of well-defined engineering problems is typified by:

- interpreting received work instructions from client and supervisor and checking with the client or supervisor that the interpretation is correct

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- collecting and organising clarifying data from all applicable sources including in-situ investigations, where appropriate
- analysing, interpreting and evaluating clarifying information to either keep or revise initial instruction.


The well-defined engineering problem may be a design requirement, an applied research and development requirement or a problematic situation in an existing component, system, or process. An example of a schema for systematic analysis is presented below wherein the applicants must develop an ability to:

- interpret the client's demands, leading to an agreed statement of requirements
- clarify the requirements and draws issues and impacts to the client's attention
- identify standards for design aspects and codes and procedures to be followed
- gather information required for problem analysis
- identify acceptance criteria for work product
- verify that the design problem is amenable to solution by his/her techniques
- document functional solution requirements and gain client acceptance.

A similar schema applies to the synthesis phase, wherein the candidate/applicant develop the following abilities:

- identifies and analyses alternative approaches for meeting the problem specification
- seeks advice on aspects of the proposal or design process that fall outside established practices or standards
- plans tasks and selects methods to complete the design process
- carries out design or develops solutions and synthesises tasks
- assembles the complete solution and reviews to check compliance with the client's requirements
- checks solution and impacts of the solution on interested and affected parties
- reviews documented design with the client to obtain formal acceptance

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#### 4.3.2 Engineering design and development of solution (Responsibility Level C and D)

During this stage, applicants demonstrate the ability to design or develop solutions to well-defined engineering problems. Applicants perform a creative, systematic analysis of problems at the required level and work systematically to synthesise solutions to the problems and can carry out the following:

- designing or developing solutions to well-defined engineering problems using appropriate theory and information technologies, while checking impacts, sustainability, and stakeholder views
- systematically synthesising solutions and providing alternatives to the work, considering the immediate requirements, impacts and costs
- stating the final solution and ensuring that the client or the supervisor agrees, and providing engineering documentation.


#### 4.3.3 Contextual knowledge (Responsibility Level E)

During this stage, applicants develop the ability to comprehend and apply knowledge embodied in established engineering practices that is specific to the jurisdiction in which the Engineering Technician practices. This outcome is normally demonstrated in the course of design, investigation or operations and the applicants must be able to:

- state what engineering principles, practices, procedures, methodologies and technologies, including the application of the theory, are applied in the practice area
- display mastery of established methods, procedures and techniques in the practice area
- apply the knowledge that underpins methods, procedures and techniques to support technician activities
- display working knowledge of areas that interact with the practice area
- demonstrating knowledge and application of engineering standards, codes of practice, legislation, regulations and finance in the practice area
- apply codified knowledge in related areas (i.e., financial, statutory, safety, management)
- use information technology effectively as required in the practice area
- Example: Know and apply ISO9001 or equivalent, SANS, COLTO or other relevant engineering standards.

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#### 4.3.4 Engineering project management (Responsibility Level D)

During this stage, applicants develop competence on managing part or all of one or more well-defined engineering activities.

Competent engineering practitioners must not only perform technical functions but must also manage engineering activities. Management of well-defined engineering activities is directed at achieving results as a member or leader of a team by planning and harnessing people, resources, processes, systems, money and contracts or agreements. Applicants must be able to:

- manage self, people, work priorities, processes and resources when performing well-defined engineering work
- plan, organise, lead and control well-defined engineering activities
- manage contracts and other agreements and the ability to establish and maintain professional and business relationships.

The progression of levels of engineering work and degrees of responsibility defined in document **R-04-T&M-GUIDE-PC**, namely Being exposed, Assisting, Participating, Contributing and Performing, also apply to the management outcomes and the communication outcome at the stage of applying for registration as a Professional Engineering Technician.

#### 4.3.5 Professional communication (Responsibility Level C)


During this stage, applicants demonstrate competence on how to communicate clearly using multiple media and collaborate inclusively with a broad range of stakeholders in the course of engineering activities.

applicants are expected to display effective communication, which can be demonstrated by the following personal and work processes:

- writing clear, concise, and effective reports that are technically, legally, and editorially correct using a structure and style that meet communication objectives and user/audience requirements
- reading and evaluating technical and legal matters relevant to the function of the Professional Engineering Technician

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- receiving instructions and ensuring correct interpretation
- issuing clear instructions to subordinates using appropriate language and communication aids, thus ensuring that language and other communication barriers are overcome
- making oral presentations using structure, style, language, visual aids, and supporting documents appropriate to the audience and purpose.

#### 4.3.6 Impact of engineering activities and risk mitigation (Responsibility Level B)

During this stage, applicants demonstrate the ability to recognise the reasonably foreseeable economic, social, cultural, and environmental effects of well-defined engineering activities, while seeking to achieve sustainability. Study the impact of activities on the communities or end user

Applicants should be allowed to study, analyse and recommend measures for:

- social/cultural impacts
- community/political considerations
- environmental impact
- sustainability analysis
- regulatory conditions
- potential ethical dilemmas.

The candidate is responsible for knowing and understanding other relevant Acts that are applicable to their area of practice. This list is not exhaustive.


#### 4.3.7 Statutory and regulatory requirements (Responsibility Level E)

During this stage, applicants develop the ability to meet all legal and regulatory requirements and protect the health and safety of persons during all well-defined engineering activities. To demonstrate competency in regulatory aspects, applicants must:

- identify the applicable legal, regulatory, and health and safety requirements for the engineering activity
- identify the risk and apply defined widely accepted risk management strategies
- select safe and sustainable materials, components, processes, and systems

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- communicate with parties involved in the legal and regulatory aspects.

Applicants are expected to have a working knowledge of the following Acts:

- Engineering Profession Act, 46 of 2000, its Rules, specifically the Code of Conduct
- Occupational Health and Safety Act, 85 of 1993 and its relevant regulations about the industry, as amended by Act 181 of 1993
- Construction Regulations.

Depending on their area of practice, applicants should have a working knowledge of the following Acts but not limited to these Acts:

- National Building Regulations and Building Standards Act, 103 of 1977, as amended by Act 49 of 1995
- Environment Conservation Act, 73 of 1989, as amended by Act 52 of 1994 and Act 50 of 2003
- Water Services Act, 108 of 1997, as amended by Act 30 of 2004
- National Water Act, 36 of 1998, as amended by Act 45 of 1999.

The candidate is expected to have a basic knowledge of the applicable Acts that are applicable to their area of practice. This list is not exhaustive.

#### 4.3.8 Ethics of Engineering (Responsibility Level E)


During this stage, applicants are expected to conduct engineering activities ethically. Ethical behaviour involves the comprehension and application of professional ethics, responsibilities, and norms of engineering practice within one's own limits of competence.

Applicants must study the ECSA Code of Conduct and be aware of its implications in situations that arise in engineering work. A candidate or applicant who is capable of handling ethical issues adopts a systematic approach to resolve ethical issues, which is typified by:

- identifying the central ethical problem
- identifying affected parties and their interests
- searching for possible solutions to the dilemma

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- evaluating each solution using the interests of those involved and according to suitable priorities
- selecting and justifying the solution that most appropriately resolves the dilemma.

#### 4.3.9 Exercising engineering sound judgement (Responsibility Level E)

Applicants should develop the ability to exercise sound judgement by evaluating the outcomes, impacts, and alternatives in the course of well-defined engineering activities.

Competence can be achieved by developing options and final solutions or approaches that consider impacts, interrelationships with other disciplines, time, cost, and other constraints including the absence of full evidence.

Exhibiting judgement is typically demonstrated by:

- considering a limited number of factors, some of which may not be well-defined
- considering the interdependence, interactions, and relative importance of factors
- foreseeing consequences of actions
- evaluating a situation in the absence of full evidence
- drawing on experience and knowledge.

#### 4.3.10 Responsibility in decision-making (Responsibility Level E)


During this stage, applicants are responsible for making decisions on part or all of well-defined engineering activities. Candidates must be able to:

- systematic gather related information and check facts and inputs required for the decision-making process
- make the final decision, based on knowledge, past experience and seek advice on matters falling outside the applicant's education and experience
- record the decision-making process and the reasons for the final decision
- take responsibility and be prepared to be held accountable for immediate consequences of own work and evaluating any shortcomings in the output.

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Applicants must demonstrate the ability to make decisions on part or all of well-defined engineering activities at the required level of degree of responsibility, which is evidenced by:

- demonstrating a professional approach at all times
- indicating due regard to technical, social, environmental, and sustainable development considerations
- take advice from a responsible authority on any matter considered to be outside one's area of competence
- evaluate work output, revising as required and taking responsibility for work output.

#### 4.3.11 Professional development (Responsibility Level D)

During this stage, applicants undertake sufficient professional development activities to maintain and extend competence and enhance the ability to adapt to emerging technologies and the ever-changing nature of work. The emphasis is on the individual's ability to self-develop. This capability has several dimensions:


- taking responsibility for one's own development
- reflecting on strengths and weaknesses, recognising needs, and planning
- executing development activities and overcoming obstacles.

All the activities listed below, including combinations thereof, constitute PD and thus, IPD:

- attending courses, seminars, congresses and technical meetings organised by engineering institutions/institutes, universities, other professional bodies and course providers
- actively participating in conferences, serving on technical or professional committees and engaging in working groups
- undertaking structured self-study (i.e., using textbooks with examples)
- studying technical literature (e.g., journals, magazines)
- taking correspondence courses, studying other supervised study packages and taking in-house courses provided by employers where applicable
- enrolling for formal postgraduate studies (limited credits)
- writing technical papers or presenting papers or lectures at organised events.

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## 5. FUNCTIONS PERFORMED

### 5.1 Degrees of responsibility


During development from the graduate level to meeting the competency requirements for registration, candidates progress through levels of work capability until the required level for registration is attained. Progression throughout the candidacy period, presented in document **R-04-T&M-Guide-PC** and below in **Table 1**, refers to the gradual increase in the degree of responsibility to which applicants are exposed during experience and training period.

**Table 1: Progression throughout the candidacy period:**

Degree of responsibility	Nature of work	Activities/duties to be undertaken during training
<b>A: Being exposed</b>	The Candidate undergoes induction and observes processes and work of competent practitioners.	candidates/applicants should be exposed to: <ul style="list-style-type: none"> <li>• scope of service in line with ECSA - guideline scope of services and tariff of fees</li> <li>• the applicable legal and regulation</li> <li>• managing finance, material and resources</li> <li>• engineering forms of contracts and condition</li> </ul>
<b>B: Assisting</b>	The Candidate performs specific processes under close supervision.	<ul style="list-style-type: none"> <li>• assist in identifying the social, cultural and environmental effects of their engineering activities</li> <li>• assist in developing or design solution within a team.</li> <li>• assist in drawing up terms of reference</li> <li>• operate engineering modelling software</li> <li>• assist with the identification of stakeholders</li> </ul>
<b>C: Participating</b>	The Candidate performs specific processes as directed, with limited supervision.	<ul style="list-style-type: none"> <li>• Should develop or design solutions to engineering problem</li> <li>• Drawing up detailed specifications (construction drawings)</li> <li>• Developing tender documents</li> <li>• Defining the channel of communication</li> <li>• In issuing clear instructions to stakeholders</li> <li>• In technical report writing and oral presentation</li> </ul>

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Degree of responsibility	Nature of work	Activities/duties to be undertaken during training
<b>D: Contributing</b>	The Candidate performs specific work with detailed approval of work outputs.	<ul style="list-style-type: none"> <li>To develop evaluation criteria and methods of analysis while developing and designing a solution</li> <li>In managing part or all of the engineering activities by managing materials, machines, manpower, methods or money, contracts</li> <li>Developing the conditions and operation of contractors and the ability to establish and maintain professional and business relationships</li> <li>Into owns professional development sufficient to maintain and extend his or her competence.</li> </ul>
<b>E: Performing</b>	The Candidate works in a team without supervision, recommends work outputs and is responsible but not accountable.	<ul style="list-style-type: none"> <li>define, investigate and analyse engineering problems</li> <li>conduct research and apply the knowledge embodied in widely accepted and applied engineering procedures and processes, systems or methodologies, and those specific to the jurisdiction in which he or she practice</li> <li>meeting all legal and regulatory requirements and protect the health and safety of persons in the course of his or her engineering activities</li> <li>conduct engineering activities ethically and be conversant and operate in compliance with ECSA's Rules of Conduct for registered persons</li> <li>exercise sound judgement in the course of engineering activities, sometimes in the absent of full experience</li> <li>Be responsible for making decisions on part or all of engineering activities using past experience, educational knowledge, and advises received from competent person.</li> </ul>

## 5.2 Candidate's training programme

The training programme for each candidate depends on the work opportunities available for the employer to assign to the a at the time. Best practice programmes are those that address the development of the competencies needed for each candidate to be able to successfully register as a Professional Engineer, Professional Engineering Technologist and Professional Engineering Technician.

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The training programme should be such that candidates/applicants progress through levels of work capability, which are described in document **R-04-T&M-GUIDE-PC**, such that by the end of the training period, candidates/applicants perform individually and as a team member at the level of problem-solving and engineering activity required for registration and exhibit degree of responsibility E.

Depending on the nature of the work undertaken by an employer, it may be possible to develop a training programme that provides opportunities for the applicant to undertake the work functions described in Section 5. In some cases, an employer may only cover some of the functions described in section 5. In such cases, the employer and candidate should make appropriate arrangements as described in section 5 of this document.

It is suggested that candidates/applicants work with their mentors to determine appropriate projects to gain exposure to elements of the asset cycle and ensure their designs are constructive, operable, and designed considering life cycle costing and long-term sustainability.


To attain registration as a professional, candidates/applicants should be able to meet the educational requirements for the category and demonstrate competency against the prescribed standard for the registration category. Demonstrating competency is achieved by meeting requirements for the 11 ECSA outcomes. Candidates or persons willing to be registered as professionals must ensure, together with their mentors, that the training being provided is geared towards achieving the ECSA competency outcomes. Focusing on one training aspect for the entire duration of training will not assist candidates/applicants in achieving the necessary skills to demonstrate all the standard competency outcomes.

The DSTG assumes that applicants enter a programme after graduation and continue with the programme until they are ready to apply for professional registration. The guide also assumes that applicants are supervised and mentored by persons who meet the requirements stated in document **R-04-T&M-GUIDE-PC**. In the case of a person changing from one candidacy programme to another or moving into a candidacy programme from a less structured environment, it is essential that the following steps are completed:

- Applicants must complete the Training and Experience Summary (TES) and the Training and Experience Reports (TERs) for the previous programme or the unstructured experience.

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Regarding the latter, it is important to reconstruct the experience as accurately as possible. The TERs must be signed off by the relevant supervisor or mentor.


- On entering the new programme, the mentor and supervisor should review a applicant's development while being mindful of the past experience and the opportunities and requirements of the new programme. At minimum, the mentor and supervisor should plan the next phase of the applicant's programme.

## 6. CONCLUSION

Generally, no matter the discipline, it is unlikely that the training period will only be 3 years, the minimum time required by ECSA. Typically, it will be longer and will be determined, among others, by the availability of functions in the actual work situation. There is no ideal training programme structure or a unique sequencing that constitutes best practice.

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## REVISION HISTORY

Revision number	Revision date	Revision details	Approved by
Rev 0 Draft A	12 Dec 2023	The DSTG have been merged into one Discipline Specific Training Guide for Registration as a Professional Engineer, Technologist and Technician in Electrical Engineering and to ensure that the DSTG clearly detail how each outcome can be achieved.	RDDR BU
Rev 0 Draft B	13 Dec 2023	<p>The review has included and introduction section the document further indicate type of engineering work that the different categories should undertake</p> <p>Section 4. Developing Competency: Document (R-08-PE/PT/PN) Under Training for Registration as a Professional Engineer, Professional Engineering Technologist, and Professional Engineering Technician has been revised to ensure that each training element is aligned to each outcome,</p> <p><i>4.1.1 Investigation &amp; Analysis</i> The content under this section is aligned with Outcome 1</p> <p><i>4.1.2 Engineering Design &amp; Development of solution</i> The content under this section is aligned with Outcome 2</p> <p><i>4.1.3 Contextual Knowledge</i> The content under this section is aligned with Outcome 3</p> <p><i>4.1.4 Engineering Project Management</i> The content under this section is aligned with Outcome 4</p> <p><i>4.1.5 Professional Communication</i> The content under this section is aligned with Outcome 5</p> <p><i>4.1.6 Impact of Engineering Activities &amp; Risk Mitigation</i> The content under this section is aligned with Outcome 6</p> <p><i>4.1.7 Statutory &amp; Regulatory Requirements</i> The content under this section is aligned with Outcome 7</p> <p><i>4.1.8 Ethics of Engineering</i> The content under this section is aligned with Outcome 8</p> <p><i>4.1.9 Exercising sound judgment</i> The content under this section is aligned with Outcome 9</p> <p><i>4.1.10 Responsibility in Decision-making</i> The content under this section is aligned with Outcome 10</p> <p><i>4.1.11 Professional Development</i> The content under this section is aligned with Outcome 11</p>	Working group

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Revision number	Revision date	Revision details	Approved by
Rev 0 Draft C	19 Dec 2023	Document revised with WG and Registration BU	RI BU, Registration BU and WG
Rev 0 Draft D	12 Mar 2024	Document submitted to the IEA Task Team for alignment to the IEA changes	IEA Review Task Team
Rev 0 Draft E	04 Apr 2024	Reviewed and checked	Executive: RPSC
Rev 0	17 Apr 2024	Approval	RPSC

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The Discipline-Specific Training Guide for:

**Registration as a Professional Engineer, Technologist or Technician in Civil Engineering**

Revision 0 dated 17 April 2024 and consisting of 41 pages reviewed for adequacy by the Business Unit Manager and is approved by the Executive: Regulatory Services & International Relations (RSIR)



Business Unit Manager

21 May 2024.....

Date



Executive: RSIR

22 May 2024.....


Date

This definitive version of this policy is available on our website.

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## APPENDIX A: TRAINING ELEMENTS

<b>1</b>	<b>Introduction</b>
1.1	Training Induction Programme (Typically, 1 to 5 days)
1.1.1	Company structure
1.1.2	Company policies
1.1.3	Company Code of Conduct
1.1.4	Company safety regulations
1.1.5	Company staff code
1.1.6	Company regulations
1.2	Exposure to engineering principles and processes (Typically, 6 to 12 months) and cover how things are: (Responsibility level A, B, C)
	(Experience in one or more of these but not all)
1.2.1	Manufacturing / Production
1.2.2	Laboratory and testing
1.2.3	Project management
1.2.4	Process optimisation and design
1.2.5	Plant operations and maintenance, construction, commissioning and decommissioning
1.2.6	Heat treatment (Use of equipment e.g., furnace, spectrometer)
1.2.7	Mechanical testing of materials
1.2.8	Non-destructive testing of materials
1.2.9	Chemical analysis
1.2.10	Problem investigation & failure investigations
1.3	Experience in design and application of design knowledge (Typically, 12 to 18 months) and would focus on planning, design and application: (Responsibility level C&D)
1.3.1	Analysis of data and systems
1.3.2	Research and investigation
1.3.3	Preparation of specifications and associated documentation
1.3.4	System modelling and integration
1.3.5	System & software designs
1.3.6	Component / Product designs
1.3.7	Preparation of contract documents and associated documentation


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1.3.8	Preparation of project management documents
1.3.9	Application of quality systems
1.3.10	Configuration and documentation management (Quality Management Systems)
1.3.11	Development of standards and procedures
1.4	Experience in the execution of engineering tasks Rest of training period, focus should be on projects and project management. (Responsibility level E)
(Working in one or more of these but not in all.)	
1.3.1	Plant & process design
1.3.2	Process optimisation
1.3.3	Manufacture / Production
1.3.4	Construction and installation
1.3.5	Project management
1.3.6	Commissioning
1.3.7	Plant operations and maintenance
1.3.8	Modifications
1.3.9	Decommissioning
1.3.10	Safety standards and processes
1.3.11	Research and development
<b>2</b>	<b>Solving problems based on engineering and contextual knowledge</b>
2.1	Conceptualisation of complex engineering problems (Responsibility Level E)
2.1.1	Receive brief
2.1.2	Investigate / evaluate requirements
2.1.3	Develop preliminary solutions
2.1.4	Justify the preliminary design
2.2	Design or development processes for complex engineering problems
2.2.1	Detailed design or development processes
2.2.2	Documentation development for Implementing PE/PT/PN engineering Solutions
<b>3</b>	<b>Implementing projects or operating engineering systems or processes</b>
3.1	Planning processes for Implementation or Operations (Responsibility Level E)
3.1.1	Develop business and stakeholder relationships
3.1.2	Scope and plan


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3.2	Organising processes for Implementation or Operations (Responsibility Level E)
3.2.1	Manage resources
3.2.1	Optimisation of resources and processes
3.3	Controlling processes for Implementation or Operations (Responsibility Level E)
3.3.1	Monitor progress and delivery
3.3.2	Monitor quality
3.4	Close out Processes for Implementation or Operations (Responsibility Level E)
3.4.1	Commissioning processes
3.4.2	Development of operational documentation
3.4.3	Handover processes
3.5	Maintenance and repair processes (Responsibility Level E)
3.5.1	Maintenance planning and scheduling
3.5.2	Monitor quality
3.5.3	Oversee repairs and/or implement remedial processes
<b>4</b>	<b>Risk and Impact Mitigation</b>
4.1	Impact and risk assessments (Responsibility Level E)
4.1.1	Impact assessments
4.1.2	Risk assessments
4.1.3	Mitigation plans
4.2	Regulatory compliance processes (Responsibility Level E)
4.2.1	Health and safety
4.2.2	Legal and regulatory
<b>5</b>	<b>Managing Engineering Activities</b>
5.1	Self-Management Processes (Responsibility Levels C–D)
5.1.1	Manage own activities
5.1.2	Communicate effectively
5.2	Team Environment (Responsibility Levels C–D)
5.2.1	Participate in and contribute to team planning activities
5.2.2	Manage people
5.3	Professional communication and relationships ( <i>networking</i> ) (Responsibility Levels C–D)
5.3.1	Establish and maintain professional and business relationships

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5.3.2	Communicates effectively
5.4	Exercising Judgement and Taking Responsibility (Responsibility Level E)
5.4.1	Ethical practices
5.4.2	Exercise sound judgement in the course of PE/PT/PN engineering activities
5.4.3	Be responsible for decision making on part or all of PE/PT/PN engineering activities
<b>5.5</b>	<b>Competency development (Responsibility Level D)</b>
5.5.1	Plan own development strategy
5.5.2	Construct initial professional development record

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