

<b>ENGINEERING COUNCIL OF SOUTH AFRICA</b> <i>Standards and Procedures System</i>			 <b>E C S A</b>
<b>Competency Standard for</b> <b>Registration as a Professional Engineering Technologist</b>			
<b>Approved by Council: Under Review Joint Implementation Committee</b>			
<b>Document : R-02-PT</b>	<b>Rev-0 Draft-6.1</b>	<b>30 January 2007</b>	

## 1 Purpose

This document defines the competency required for registration with the Engineering Council of South Africa as a Professional Engineering Technologist. Section 2 defines the set of outcomes to be satisfied, together with typifying assessment criteria and range statements. Section 3 defines the general range of problem solving, engineering activities and required knowledge.

## 2 Outcomes that Demonstrate Competency

The candidate evidences the required competency by demonstrating, in an integrated manner, in a workplace context, the following outcomes within *broadly-defined engineering activities* and solving *broadly-defined engineering problems* defined in the General Range Statement.

### Learning outcome 1:

Identify, clarify, and analyse broadly-defined engineering problems.

**Assessment Criteria:** The candidate is expected to perform a structured analysis of problems typified by the following performances:

1. Interprets and clarifies requirements, leading to an agreed definition of the problem to be addressed;
2. Identifies interested and affected parties and their expectations;
3. Gather, structure and evaluate a sufficient range of information relating to the problem;
4. Perform structured analysis;
5. Evaluate the result of the analysis and revise or refine as required;
6. Document and report conveying outcome to the requesting party.

**Range Statement:** The problem may be a design requirement, an applied R&D requirement or a problematic situation in an existing component, system or process. The problem is one amenable to solution by technologies known to the candidate. This outcome is concerned with the understanding of a problem: Outcome 2 is concerned with the solution.

### Learning outcome 2:

Design or develop solutions to broadly-defined engineering problems

**Assessment Criteria:** This outcome is normally demonstrated after a problem analysis as defined in outcome 1. The candidate is expected to work systematically to synthesise a solution to a problem, typified by the following performances:

1. Proposes potential approaches to the solution;
2. Conducts a preliminary synthesis following selected approaches;
3. Evaluates potential solutions against requirements and wider impacts;
4. Presents reasoned technical, economic and contextual arguments for the selected option;
5. Fully develop chosen solution;
6. Evaluate the resulting solution;
7. Document the solution for approval and implementation.

**Range Statement:** The solution may be the design of a component, system or process or a recommendation of the remedy to a problematic situation. Solutions are those enabled by the technologies in the candidate's practice area.

**Learning Outcome 3:**

Comprehend and apply the knowledge embodied in widely accepted and applied engineering procedures, processes, systems or methodologies and those specific to the jurisdiction in which he/she practices.

**Assessment criteria** This outcome is normally demonstrated in the course of design, investigation or operations. The candidate typically:

1. Displays mastery of understanding of current and emerging technologies in the practice area;
2. Applies general and underpinning engineering knowledge to support technologist activities;
3. Displays working knowledge of areas that interact with the practice area;
4. Applies related knowledge: financial, statutory, safety, management.

**Range Statement:** Technological knowledge is well-established and applicable to the practice area irrespective of location, supplemented by locally relevant knowledge, for example, established properties of local materials. Jurisdictional knowledge includes legal and regulatory requirements as well as prescribed codes of practice. Emerging technologies are adopted from formulations of others.

**Learning outcome 4:**

Manage part or all of one or more broadly-defined engineering activities

**Assessment criteria:** The candidate is expected to display personal and work process management abilities:

1. Manage self;
2. Works effectively in a team environment;
3. Manage people, work priorities and resources;
4. Establish and maintain professional and business relationships.

**Range Statement:** These management abilities support the effective discharge of responsibilities as a technologist.

**Learning outcome 5:**

Recognise and address the foreseeable social, cultural and environmental effects of broadly-defined engineering activities generally.

**Assessment criteria:** This outcome is normally displayed in the course of analysis and solution of problems. The candidate typically:

1. Identify interested and affected parties and their expectations;
2. Identify environmental impacts of the engineering activity;
3. Propose and evaluate measures to mitigate negative effects of engineering activity;
4. Communicate with stakeholders.
5. Adopt measures to mitigate negative effects of engineering activity.

**Range Statement:** Impacts considered extend over the lifecycle of the project and include the consequences of the technologies applied.

**Learning outcome 6:**

Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her broadly-defined engineering activities.

**Assessment criteria:** The candidate is expected to

1. Identify applicable legal, regulatory and health and safety requirements for the engineering activity;
2. Select safe and sustainable materials, components and systems;
3. Identify risk and apply defined, widely accepted risk management strategies;
4. Communicate with parties involved in legal and regulatory aspects of work.

**Range Statement:** Requirements include both explicitly regulated factors and those that arise in the course of particular work. Persons whose health and safety are to be protected are both inside and outside the workplace.

**Learning outcome 7:**

Conduct his or her engineering activities ethically.

**Assessment criteria:** The candidate is expected to be sensitive to ethical issues and adopt a systematic approach to resolving these issues typified by:

1. Identify the central ethical problem;
2. Identify affected parties and their interests;
3. Search for possible solutions for the dilemma;
4. Evaluate each solution using the interests of those involved, accorded suitable priority;
5. Select and justify solution that is best resolves the dilemma.

**Range Statement:** Ethical behaviour is at least that defined by the Code of Conduct.

**Learning outcome 8:**

Exercise sound judgement in the course of broadly-defined engineering activities.

**Assessment criteria** A candidate typically exhibits judgement by:

1. Considers several factors, some of which may not be well defined;
2. Considers the interdependence, interactions and relative importance of factors;
3. Foresees consequences of actions;
4. Evaluates a situation in the absence of full evidence;
5. Draw on experience and knowledge;
6. Justify judgements on risks associated with decisions.

**Range Statement:** Judgement is expected both within the application of the candidate's technologies, in their wider impacts and when dealing with interfaces to other disciplines and technologies.

**Learning outcome 9:**

Be responsible for making decisions on part or all of one or more broadly-defined engineering activities.

**Assessment criteria:** The candidate displays responsibility by performance of:

1. Demonstrates a professional approach at all times;
2. Has due regard to technical social, environmental and sustainable development considerations;
3. Takes advice from a responsible authority on any matter considered to be outside area of competence;
4. Makes decisions<sup>1</sup> on and takes responsibility for work output.

**Range Statement:** The candidate is expected to demonstrate adequately discharging responsibility for significant parts of one or more broadly-defined engineering activity.

**Note 1:** The candidate in demonstrating responsibility would work under the supervision of a competent engineering practitioner who takes the actual responsibility but is expected to perform as if he/she is in a responsible position.

**Learning outcome 10:**

Communicate clearly with others in the course of his or her broadly-defined engineering activities.

**Assessment criteria:** The candidate demonstrates effective communication by:

1. Writes clear, concise, effective, technically, legally and editorially correct reports using a structure and style which meets communication objectives and user/audience requirements.
2. Reads and evaluate technical and legal matter relevant to the function of the Professional Engineering Technologist
3. Receives instructions, ensuring correct interpretation.
4. Issues clear instructions to subordinates using appropriate language and communication aids, ensuring that language and other communication barriers are overcome.
5. Makes oral presentations using structure, style, language, visual aids and supporting documents appropriate to the audience and purpose.

**Range Statement:** Material relates to technical aspects and wider impacts of professional work. Audience includes peers, other disciplines, client and stakeholders audiences. Appropriate modes of communication must be selected. While the assessment criteria are similar to those at Stage 1, the Stage 2 Engineering technologist is expected to perform the communication functions reliably and repeatably.

**Learning outcome 11:**

Undertake professional development activities sufficient to maintain and extend his or her competence.

**Assessment criteria:** The candidate manages his or her own professional development by typically:

1. Plans own professional development strategy
2. Selects appropriate professional development activities;
3. Keeps record of professional development strategy and activities
4. Completes professional development activities.

**Range Statement:** In proceeding from Stage 1 to Stage 2, the candidate must bear this competency standard in mind in developing the strategy and activities. A candidate in a structured programme is expected to take ownership of the strategy. Boundaries of practice area linked to technologies used, change by adoption of new technology into current practice

### **3 General Range Statement:**

**Practice Area:**

Each engineering technologist, by the time of reaching the point of assessment against this standard, will have followed a programme of education, training and experience that may conform to an established pattern or may be distinctive. Each individual therefore develops an area of knowledge and expertise that may be distinctive. This pattern of knowledge and expertise is termed the individual's *practice area*.

**Broadly-defined Engineering Activities (BDEA):** are characterized by several or all of:

- *Activities* involve one or more of: design; planning; investigation and problem resolution; improvement of materials, components, systems or processes; engineering operations; project management; research, development and commercialisation.

- *Boundaries* of practice area are linked to technologies used, and change by adoption of new technology into current practice.
- Practice area is located within a wider, complex *context*, requires teamwork, has interfaces to other parties and disciplines.
- Involve the use a variety *resources* (including people, money, equipment, materials, technologies), dealing with risks in practice area.
- Require resolution of occasional problems arising from *interactions* between wide-ranging or conflicting technical, engineering or other issues.
- *Constrained* by available technology, time, finance, infrastructure, resources, facilities, standards & codes, applicable laws.

**Broadly-defined Engineering Problem (BDEP):** are characterized by several or all of:

- Requires underpinning knowledge and skills in the technology area.
- May encompass systems within complex engineering systems.
- Ill posed, under or overspecified problems requiring identification and interpretation into practice area.
- Information from sources interfacing with practice area is complex and possibly incomplete, requires analysis and compilation into information base.
- Can be solved by structured analysis techniques.
- Involves a variety of factors which may impose conflicting constraints.
- Belong to families of problems which are solved in well-accepted and innovative ways
- Problems may be partially outside standards and codes; operate outside with justification
- Involves several groups of interested and affected parties with differing and occasionally conflicting needs
- Have significant consequences which are important in practice, but may extend more widely
- Requires judgment in decision making, in practice area, considering interfaces to other areas

#### **Knowledge**

- As required for practice area, a selection of: Law of contract, Health and Safety, intellectual property, Environmental, contract administration, quality management, hazard & operability study, Project management, maintenance management, project & construction management.
- Working knowledge of interacting disciplines/technologies (engineering and other) to underpin teamwork.
- Experience of a range of broadly-defined engineering activities in the practice area.
- Understanding and acceptance of taking responsibility within broad parameters and functions and behaving ethically.

#### **4 Revision History**

<b>Version</b>	<b>Date</b>	<b>Status/Authorised by</b>	<b>Nature of Revision</b>
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