Gearing up to meet Africa’s rising power and water demand

- Rod Harker
- Volunteer
- ECSA
- South Africa
ENGINEERING COUNCIL OF SOUTH AFRICA
REGISTRATION

AFRICAN UTILITY WEEK

14 May 2015
ECSA

- Statutory body
- Academic standards
- Professional development and registration
- Identification of engineering work
- Professional conduct
- Government liaison
- International recognition
# CATEGORIES

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>SECTION IN ACT</th>
<th>SUB-CATEGORY</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFESSIONAL</td>
<td>18.(1)(a)</td>
<td>▪ Professional Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Professional Engineering Technologist</td>
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<tr>
<td></td>
<td></td>
<td>▪ Professional Certificated Engineer</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Professional Engineering Technician</td>
</tr>
<tr>
<td>CANDIDATE</td>
<td>18.(1)(b)</td>
<td>▪ Candidates for above categories</td>
</tr>
<tr>
<td>SPECIFIED CATEGORY</td>
<td>18.(1)(c)</td>
<td>▪ Lift Inspector</td>
</tr>
<tr>
<td></td>
<td></td>
<td>▪ Lifting Machinery Inspector, etc.</td>
</tr>
</tbody>
</table>
WHY REGISTER (1)

- Professional status
- Marketability and financial gain
- Trust and recognition by peers in the profession
- Professional competence
WHY REGISTER (2)

- Prerequisite in terms of external legislation impacting on the engineering profession
- Statutory requirement
- Work reservation
- International recognition
- High risks involved in engineering
ENGINEERING TEAM

Engineer
(Visionary/Innovator)

Technologist
(Doer/Achieve)

Technician
(Operator/Fixer)

Analyse, Innovate,
Create, Develop

Apply, Implement,
Develop

Install, Commission,
Maintain, Operate

WORLD 1 5 5
UK (Ideal) 1 10 100
Research 1 - 4
Maintenance 1 10 100

Different education and training but of equal value in the team
ENGINEERING TEAM

- It is useful to understand the engineering team concept to explain how the different registrations work together. It must be stressed that those registered are “different but of equal value”. Each member has a vital part to play in the Engineering Team, a point emphasised by ECSA.

- The focus and composition of the engineering team will be determined by the scope and business of the employing organisation.

- All members of the engineering team contribute in some way to the creation of products, systems, procedures, and the rendering of engineering services.
PROFESSIONAL ENGINEER (Pr Eng)

Experience standards are characterised by:

- Activities that are essentially intellectual
- Analysing and solving complex problems
- Developing and applying new technologies creatively and innovatively
- Exercising professional judgement
- Managing resources
PROFESSIONAL ENGINEERING TECHNOLOGIST (Pr Tech Eng)

Experience standards are characterised by:

- Solving **broadly defined** problems through application of proven techniques and procedures
- Developing, maintaining and managing today’s technologies
- Exercising Professional judgement
- Managing resources
PROFESSIONAL CERTIFICATED ENGINEER (Pr Cert Eng)

Experience standards are characterised by:

- Solving **broadly defined** problems through application of proven techniques and procedures
- Developing, maintaining and managing today’s technologies
- Exercising professional judgement
- Managing resources
- Assumes responsibility as the appointed competent person in terms of OHS, MHS and Merchant shipping Acts
Experience standards are characterised by:

- Solving well defined problems using proven techniques and procedures.
- Supervision and technical responsibility.
- Contributing to implementation, operation and maintenance of products, equipment, processes and services.
PROFESSIONAL REGISTRATION REQUIREMENTS

Worldwide - Based on two requirements:

- Academic entry level qualification (Educational standard).

- Three years of practical / technical post qualification training at the appropriate Engineering level for the category of registration concerned (Experience standards for category of registration concerned).
Professional Development Model

Accredited Programme
Training And Experience (Life long)

Meet Standard for Engineering Education
Meet Standard for Professional Competency
Observe Code of Conduct and Maintain Competence through CPD

5 - Yearly Renewal of Professional Registration
Candidate Registration
Graduation / Certification

Professional Registration
PROCEDURE TO REGISTER WITH ECSA

Step 1: “Candidate” Registration in order to have qualifications evaluated.

- All applicants with non-accredited and non South African qualifications have to apply for “Qualification Evaluation” which is done by ECSA’s Qualification Evaluation Committee (QEC).

<table>
<thead>
<tr>
<th>Candidate Engineer</th>
<th>BSc(Eng)/BEng</th>
</tr>
</thead>
<tbody>
<tr>
<td>Candidate Eng Techno</td>
<td>BTech</td>
</tr>
<tr>
<td>Candidate Cert Eng</td>
<td>Cert of Competency</td>
</tr>
<tr>
<td>Candidate Eng Techni</td>
<td>NDip</td>
</tr>
</tbody>
</table>
HOW TO PREPARE

- Register as a **Candidate**
- Acquire the necessary professional skills
- Commitment and undertaking
- Obtain a mentor
- Assume responsibility for your training
- Record your initial professional development
- Join a recognised voluntary association
ACCEPTABLE EXPERIENCE
(1)

- Design
- Planning
- Synthesis
- Analysis
- Problem identification
- Problem solution
ACCEPTABLE EXPERIENCE

(2)

- Application of Engineering Principles
- Supervision and leadership
- Responsibility
- Conditions of contract / finance
- Code of conduct
- Safety, health and environment
- Legal implications
NEW REGISTRATION SYSTEM

- To be implemented as from May 2014 for the Engineer category and evolving for the Technologist and Technician categories.

- New policy guideline documents are competency based and will substitute current documents.

- Moving towards electronic system of applying for registration as from Late 2014.

The new system for the engineer category will be phased in over a period of two years, commencing as from May 2014.

Candidate engineers who trained under the current registration system will be allowed to apply in terms of the current requirements/documentation till 31 March 2016.

The current requirements for civil candidates of writing two essays at the professional review and mechanical candidates to hand in a design report and for electrical engineers to hand in forms AD7, AD8, and AD9 would then still apply.
New Registration Process Guideline Documents

New Guideline format:

- R-01-P Policy on Registration of Persons in Professional Categories
- R-02-PE Competency Standard for Registration as a Pr Engineer
- R-03-PE Processing of Applications for Registration as Candidate Engineer and Professional Engineer
- R-04-P Training and Mentoring Guide for Professional Categories
- R-08-PE Guide to the Competency Standards for Registration as a Professional Engineer
- R-05-PE Discipline-specific Training Guidelines (still under development)
- E-17-P Criteria and Processes for Recognition of Educational Qualifications (all professional categories)
ECSA Professional Competencies – where training must lead

Outcome Group
CEP = Complex Engineering Problem
DoR = Degree of Responsibility
CEA = Complex Engineering Activity
R-02-PE, PT, PN: Formal Outcomes with Levels (NRS)

Group A: Engineering Problem Solving

1:- Define, investigate and analyse complex/broadly defined/well defined engineering problems.

2:- Design or develop solutions to complex/broadly defined/well defined engineering problems.

3:- Comprehend and apply advanced knowledge: principles, specialist knowledge, jurisdictional and local knowledge.

Level Descriptor: Complex Engineering Problems require:

a) Require in-depth fundamental and specialized engineering knowledge;

and one or more of:

b) are ill-posed, under- or over specified, requiring identification and refinement;

c) are high-level problems including component parts or sub-problems;

d) are unfamiliar or involve infrequently encountered issues;

e) solutions are not obvious, require originality or analysis based on fundamentals;

f) are outside the scope of standards and codes;

g) require information from variety of sources that is complex, abstract or incomplete;

h) involve wide-ranging or conflicting issues: technical, engineering and interested or affected parties;

and one or both of:

i) requires judgement in decision making in uncertain context;

j) have significant consequences in a range of contexts.
R-02-PE, PT, PN: Formal Outcomes

Group B: Managing Engineering Activities

4:- Manage part or all of one or more complex/broadly defined/well defined engineering activities.

5:- Communicate clearly with others in the course of his or her engineering activities.

Complex engineering activities are characterised by several or all of:

- **Scope** of activities may encompass entire complex engineering systems or complex subsystems.
- The **context** is complex and varying, is multidisciplinary, requires teamwork, unpredictable, may need to be identified.
- Requires diverse and significant **resources**: including people, money, equipment, materials, technologies.
- Significant **interactions** exist between wide-ranging or conflicting technical, engineering or other issues.
- Are **constrained** by time, finance, infrastructure, resources, facilities, standards & codes, applicable laws.
- Have significant **risks** and **consequences** in a range of contexts.
Group C: Impacts of Engineering Activities

6: Recognize and address the reasonably foreseeable social, cultural and environmental effects of complex/broadly defined/well defined engineering activities.

7: Meet all legal and regulatory requirements and protect the health and safety of persons in the course of his or her complex/broadly defined/well defined engineering activities.

Group D: Exercise judgement, take responsibility and act ethically

8: Conduct engineering activities ethically.

9: Exercise sound judgement in the course of complex engineering activities.

10: Be responsible for making decisions on part or all of complex engineering activities.

Group E: Initial Professional Development

11: Undertake professional development activities sufficient to maintain and extend his or her competence.
ENGINEERING REPORT

Engineering Report of up to 6000 words (par 4.5 of R-03-PE) covering aspects of work at the Perform Level that demonstrates an applicant’s fulfillment of the 11 outcomes.

- Not “simply report on a specific project.” Work drawn on for the report does not have to be project based; in an operational environment, problem solving and engineering management may provide evidence of performance against required outcomes.

- Report should be reflective rather than narrative. It is a test of written communication ability.
Broadly-Defined Engineering Problems

a) require a coherent and detailed knowledge of defined aspects of a professional discipline with a strong emphasis on the application of developed technology;

and the problem has one or more of the characteristics:

b) may be concrete or ill-posed, requiring identification and refinement;

c) are parts of, or systems within complex engineering problems of the sub-discipline;

d) maybe unfamiliar but involve frequently encountered issues;

and solutions are characterised by one or more of:

e) can be solved by application of well-proven analysis techniques;

f) may be partially outside those encompassed by standards or codes of practice

g) require information from variety of sources that is generally well known, or possibly incomplete;

h) involve a variety of factors which may impose conflicting constraints:
   technical, engineering and interested or affected parties.

and one or both of:

i) requires judgement in decision making in practice area, considering interfaces to other areas;

j) have significant consequences which are important in practice area, but may extend more widely.
BROADLY-DEFINED ENGINEERING ACTIVITIES (TECH)

Broadly-defined Engineering Activities: are characterised by several or all of:

(a) **Scope** of practice area is linked to technologies used and changes by adoption of new technology into current practice;

(b) Practice area is located within a wider, complex **context**, requires teamwork, has interfaces to other parties and disciplines;

(c) Involve the use a variety **resources** (including people, money, equipment, materials, technologies);

(d) Require resolution of occasional problems arising from **interactions** between wide-ranging or conflicting technical, engineering or other issues;

(e) Are **constrained** by available technology, time, finance, infrastructure, resources, facilities, standards and codes, applicable laws;

(f) Have **significant risks** and **consequences** in practice area and in related areas.
Well-Defined Engineering Problems

Well-Defined Engineering Problems

a) require limited theoretical knowledge but normally requires extensive practical knowledge;

and the problem has one or more of the characteristics:

b) are concrete, requirements are largely complete but may require refinement;

c) are discrete components of engineering systems;

d) maybe unfamiliar but occur in familiar contexts;

and solutions are characterised by one or more of:

e) can be solved by standardised methodologies or codified best practice;

f) are encompassed by standards, codes and documented procedures;
   judgment of outcome is required

g) require information that is concrete and largely complete, requires validation and possible supplementation;

h) involves several issues, but with few of these impose conflicting constraints: technical, engineering and interested or affected parties.

and one or both of:

i) requires practical judgement in practice area in evaluating solutions, considering interfaces to other roleplayers;

j) have consequences which are locally important but not far reaching.
WELL-DEFINED ENGINEERING ACTIVITIES (TECHNI)

Well-defined Engineering Activities: are characterised by several or all of:

(a) **Scope** of practice area is defined by techniques applied; change by adopting new techniques into current practice;
(b) Practice area is located within a wider, complex **context**, with well-defined working relationships with other parties and disciplines;
(c) Work involves familiar, defined range of **resources** (including people, money, equipment, materials, technologies);
(d) Require resolution of **interactions** manifested between specific technical factors with limited impact on wider issues;
(e) Are **constrained** by operational context, defined work package, time, finance, infrastructure, resources, facilities, standards and codes, applicable laws;
(f) Have **risks** and **consequences** that are locally important but are not generally far reaching.
PRACTICAL WORK EXPECTED FROM LECTURERS (ENGINEER CATEGORY)

• Consulting work in which the applicant has demonstrated ability at a professional level to identify engineering problems and produce solutions

• Planning, design, development, commissioning and/or application of research equipment or processes associated with engineering projects;

• Be responsible for the management of workshops, laboratories and ancillary facilities;

• Execution of research projects and results (preferably published), which includes the application of the essential practical training elements stated in section 5 of R2/1A
PRACTICAL WORK... engineer continued...

• Supervise final year projects
• Preferably supervise post graduate students
• Be aware of Health, Safety and Environmental legislation
• Be aware of conditions of contract
• Project a professional attitude, i.e. operate, make engineering judgements and take responsibility expected of a professional engineer.
5.1: Problem Investigation
The work must be aimed at investigating engineering problems and for which engineering judgement is required. The following practical engineering functions are contained in such work to a greater or lesser degree:
(a) problem identification and formulation;
(b) finding and selecting relevant information;
(c) evaluating, investigating, testing and research;
(d) analysis of all factors that influence the solution like relevant engineering & scientific principles;

5.2 Problem Solution
The work must be aimed at ....

5.3 Execution / Implementation
The work must be aimed at ....

5.4 Responsibility (required level)
The work must be aimed at increasing engineering and managerial responsibility until candidate engineers are clearly able to accept professional responsibility for taking engineering decisions. Part of their responsibility should also be to ensure that sufficient cognisance is taken of economic considerations, social circumstances, environmental factors, quality assurance, safety and legal aspects as well as of the code of professional conduct.
APPLICATION REQUIREMENTS
(EXISTING SYSTEM)

- Personal details (Forms A1.1 & 1.2 engineers and B.1 & B.2 technologists and C.1 & C.2 technicians)
- Summary of Training Periods (A2.2, B2.2 & C2.2 respectively)
- Training/Experience Reports (approx 2000 words) (A 2.1)
- Confidential Referee Reports
- Project Report/Design Report
- Certified copies of qualification documents (and transcripts of subjects take for technologist category)
- Proof of membership of Voluntary Association (if applicable)
- Application fee
COMMON REPORT PROBLEMS

- Lack of application of technical knowledge
- Lack of professional appreciation
- Over-specialization... giving a narrow view
- Poor organization of thoughts displayed in reports and essays
- Poor communication
- Poor English writing skills
- Insufficient Experience
TIPS ON EXPERIENTIAL REPORTS

- Sell yourself
- Write in the first person
- Detail what you have done
- Describe what you have done and indicate your level of responsibility
- Do not generalize
- All periods must be covered
PLANNING PRINCIPLES: TRAINING PROGRAMMES

Two principles must be followed by supervisors and mentors when planning training programmes for candidates:

- Firstly, a variety of work activities is necessary for the proper development of a candidate.
  
  Variety may be obtained at the various stages in the lifecycle of an engineering activity: conception, planning, design, construction, implementation, operation and closure.

- Secondly, increasing responsibility and accountability must be imposed on and accepted by the candidate until he/she is capable of accepting professional responsibility in making and executing engineering decisions at the expected level of a professional
<table>
<thead>
<tr>
<th>Level</th>
<th>Nature of Work</th>
<th>Responsibility</th>
<th>Level of Support</th>
<th>Typical time</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Being Exposed</td>
<td>Induction/Observe</td>
<td>None</td>
<td>Explains challenges/solutions</td>
<td>6 to 12 months</td>
</tr>
<tr>
<td>B. Assisting</td>
<td>Performs under close supervision</td>
<td>Limited for work output</td>
<td>Coaches and feedback</td>
<td></td>
</tr>
<tr>
<td>C. Participating</td>
<td>Performs under limited supervision</td>
<td>Full for supervised work</td>
<td>Progressively reduces support</td>
<td>12 to 18 months</td>
</tr>
<tr>
<td>D. Contributing</td>
<td>Performs with approval of work output</td>
<td>Full to supervisor for quality of work</td>
<td>Candidate articulates own reasoning and compares</td>
<td></td>
</tr>
<tr>
<td>E. Performing</td>
<td>Works without supervision</td>
<td>Full as appropriate for a registered person</td>
<td>Candidate takes on without support/limited guidance</td>
<td>12 months</td>
</tr>
</tbody>
</table>
THANK YOU!

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