CANDIDATE GUIDE

DESIGN OR DEVELOP SOLUTIONS

OUTCOME 2

TABLE OF CONTENTS PAGE NO.

CANDIDATE INFORMATION 4

COMPETENCY STANDARD REQUIREMENTS 5

KEYS TO ICONS 6

GENERAL GUIDELINES 7

CANDIDATE SUPPORT 8

SECTION 1: AN INTRODUCTION TO THE DESIGN OR DEVELOPMENT OF SOLUTIONS TO COMPLEX ENGINEERING PROBLEMS 10

1.1 What is Engineering?
1.2 Engineering Problems
1.3 Complex Problems
1.4 Designing or developing
1.5 Solutions

INITIAL TEST

SECTION 2: A PRACTICAL DESIGNING OR DEVELOPING MODEL FOR SOLUTIONS AS PER THE ASSESSMENT CRITERIA 18

2.1 Introduction
2.2 Steps in designing or developing solutions
STEP 1: Analyse the design/planning/solution requirement and draw up detailed requirements specification
STEP 2: Synthesise a range of potential solutions to problem or approaches to developing a solution
STEP 3: Evaluate the potential approaches against requirements, including cost, and impacts outside requirements

STEP 4: Present reasoned arguments and proposal for preferred option
STEP 5: Fully develop design of selected option
STEP 6: Evaluate resulting solution
STEP 7: Produce design documentation for implementation

ASSESSMENT TEST

SECTION 3: GENERIC GUIDELINE: LEARNING OUTCOMES AND ASSESSMENT CRITERIA ARE THE GUIDING PRINCIPLES OF PROFESSIONAL PRACTICE 31

APPENDICES 33

REFERENCES 38

RECORDING OF REPORTS 39

ASSESSMENT PROCESS 40

CANDIDATE INFORMATION

Details	Please Complete details
Name of candidate	
Name of supervisor	
Work Unit	
Name of mentor	
Date started	
Date of completion & Assessment	

COMPETENCY STANDARD REQUIREMENTS

(Direct extract from SAIMechE's Standard of Professional Competency)

LEARNING OUTCOME 2

Design or develop solutions to complex 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:

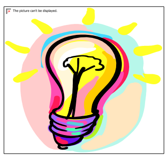
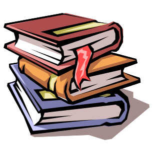
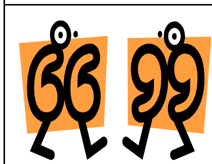
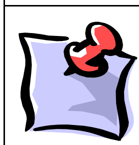
1. Analyse the design/planning/solution requirement and draw up detailed requirements specification;
2. Synthesise a range of potential solutions to problem or approaches to developing a solution;
3. Evaluate the potential approaches against requirements, including cost, and impacts outside requirements;
4. Present reasoned arguments and proposal for preferred option;
5. Fully develop design of selected option;
6. Evaluate resulting solution;
7. Produce design documentation for 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.

KEYS TO ICONS

The following icons are used throughout the study guide to indicate specific functions:

	**DON'T FORGET/NOTE** **This icon indicates information of particular importance**
	**CANDIDATE GUIDE** **This refers to the learning material in this module which is aligned to the SAIMechE Competency Standard**
	**EXERCISES** **Practical activities to do, either individual or in syndicate groups during the training process**
	**BOOKS AND WEBSITES** **Additional resource information for further reading and reference**
	**SELF TEST QUESTIONS** **Self-evaluation for candidates to test understanding of the learning material**
	**QUOTATIONS** **Quotations which offer interesting points of view and statements of wisdom and insight**
	**YOUR NOTE PAD** **Provided for candidate to document notes during presentation of training**

GENERAL GUIDELINES

PURPOSE

This module provides an introduction to the basic concepts that you will need to understand relating the design or development of solutions to complex engineering problems. Easy-to-follow steps based on the assessment criteria of the competency standard will equip you with the skills to:

1. Know the definitions and major concepts relating to engineering
2. Understand the meaning of complex engineering problems
3. Introduce you to the process of designing or developing solutions to these complex engineering problems as defined in Outcome 1
4. Follow the assessment criteria steps when working towards the best solution to the problem

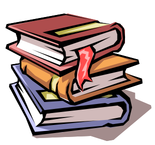
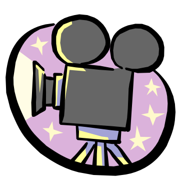
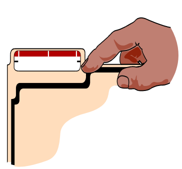
This module introduces you to these design and developing concepts and criteria. While it may be impossible and impractical to present in this module all the guidelines pertaining to engineering practice, certain issues of relevance will be highlighted and discussed. You, the candidate, are expected to expand your awareness of this process through workplace projects and further reading and learning.

Candidates will have the opportunity to discuss and debate design or development issues during the workshop, and thereby understand and be better equipped to use these concepts and processes in the workplace.

LEARNING OUTCOME AND RANGE OF LEARNING

This programme uses the basic structure of SAIMechE's Competency Standard, and specifically the assessment criteria, to take you through the process of learning, as an understanding of the assessment criteria and the range of understanding required is fundamental to professional competence.

CANDIDATE SUPPORT

Resources	Candidate Guide 	The Candidate Guide is a manual covering the theory on the comprehension and development of advanced knowledge, and provides the guidance on practical exercises to meet the requirements of the assessment criteria
	Candidate Portfolio of Evidence Guide	This is a separate document which provides guidelines for Candidates on how to compile their portfolio of evidence, and a template to structure their practical task evidence into a file format for assessment by the mentor/referee
	Books and websites 	Refer to references at the end of the Candidate Guide
	Videos 	Refers to any videos that are regarded as relevant to the subject
	Folder enclosures 	This includes all handouts, checklists, etc. “The Engineer’s Code of Conduct”

SECTION 1

DESIGN OR DEVELOP SOLUTIONS

LEARNING OUTCOMES:

- Define and describe what is meant by the word, “engineering”
- Understand the concept of complex engineering problems
- Be aware of the need to design or develop solutions to these problems

1.0 DESIGN OR DEVELOP SOLUTIONS

1.1 What is Engineering?

1.1.1 Definition of Engineer

Dictionary definition: The colloquial (general familiar use) of the word “engineer” as per the Oxford Concise Dictionary means to arrange, contrive or bring about something.
The history of the concept of "engineering" stems from the earliest times when man began to make clever inventions, such as the pulley, lever, or wheel, etc. The exact etymology of the word engineer, however, is a person occupationally connected with the study, design, and implementation of engines. The word "engine", derives from the Latin “*ingenium*” (c. 1250), meaning "innate quality, especially mental power, hence a clever invention." Hence, an engineer, essentially, is someone who makes useful or practical inventions.
(http://en.wikipedia.org/wiki/Engineering)

The term *engineering* itself has a much more recent etymology, deriving from the word *engineer*, which itself dates back to 1325, when an *engine'er* (literally, one who operates an *engine*) originally referred to "a constructor of military engines”. In this context, now obsolete, an "engine" referred to a military machine, *i.e.*, a mechanical contraption used in war (for example, a **catapult**). Notable exceptions of the obsolete usage which have survived to the present day are military engineering corps, *e.g.*, the **U.S. Army Corps of Engineers.**
(http://en.wikipedia.org/wiki/Engineering)

1.1.2 Engineering

The **American Engineers' Council for Professional Development]** has defined "engineering" as:

The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes, or works utilizing them singly or in combination; or to construct or operate the same with full cognizance of their design; or to forecast their behaviour under specific operating conditions; all in respect of an intended function, economics of operation or safety to life and property.
(http://en.wikipedia.org/wiki/**Engineering)**

1.1.3 A brief history

The first engineers were military engineers, employed by the government, who concerned themselves with subjects such as military "engines", roads, bridges, and fortifications. The first schools of engineering were founded in France in the middle of the 18th Century. By the turn of the Century, France had established military and polytechnic schools to teach engineering that produced such notables as Laplace, Lagrange, and Fourier.
(http://www.seas.ucla.edu/hsseas/history/origin.html)

1.1.3 Engineering as a Profession

It is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs and homes to men. Then it elevates the standards of living and adds to the comforts of life. That is the engineer's high privilege.
(http://www.hooverassociation.org/hoover/speeches/engineering_as_a_profession.php)

1.2 Engineering Problems

1.2.1 Problems

As per the Oxford dictionary a problem is a doubtful or difficult question. It is a thing hard to understand.

A **problem** is an obstacle, impediment, difficulty or challenge, or any situation that invites **resolution**; the resolution of which is recognized as a solution or contribution toward a known **purpose** or goal. A problem implies a desired outcome coupled with an apparent deficiency, **doubt** or inconsistency that prevents the outcome from taking place.
(http://en.wikipedia.org/wiki/Problem)

If water is flowing in a river and running into a dam but the people on the hill want some of the water in their houses they could say they have a problem. The solution to the problem is the challenge that needs to be addressed.

1.2.2 Engineering problems

Above we have defined engineering as "The creative application of scientific principles to design or develop structures, machines, apparatus, or manufacturing processes" so we can say that engineering problems are those problems that could be resolved by the application of scientific principles to the situation. Engineering problems are those issues that can be resolved by the application of the imagination to design or develop machines, apparatus or manufacturing processes that will resolve the problem and contribute towards elevating the standards of living and adding to the comforts of life.

1.3 Complex Problems

1.3.1 Complex

Dictionary definition - “consisting of parts, complicated”. Something that is complex has many parts, many different parts, many different layers that in themselves have different levels of complexity. A complex problem is therefore one with many different aspects, levels , layers and so the solution related to this problem is not likely to be what presents itself on the surface.

1.3.2 Complex Problems

The following definition is taken from the IEA (International Engineering Alliance) Graduate Attributes and Professional Competencies Version 2 - 18 June 2009. The attributes are underlined with the definition of a complex problem following.

<u>Preamble:</u> “Complex Engineering Problems” which cannot be resolved without in-depth engineering knowledge, much of which is at, or informed by, the forefront of the professional discipline, and have some or all of the following characteristics:
<u>Range of conflicting requirements:</u> Involves wide-ranging or conflicting technical, engineering and other issues
<u>Depth of analysis required:</u> Have no obvious solution and require abstract thinking, originality in analysis to formulate suitable models
<u>Depth of knowledge required:</u> Requires research-based knowledge much of which is at, or informed by, the forefront of the professional discipline and which allows a fundamentals-based, first principles analytical approach
<u>Familiarity of issues:</u> Involves infrequently encountered issues
<u>Extent of applicable codes:</u> Are outside problems encompassed by standards and codes of practice for professional engineering
<u>Extent of stakeholder involvement and level of conflicting requirements:</u> Involve diverse groups of stakeholders with widely varying needs.

Consequences: Have significant consequences in a range of contexts
Interdependence: Are high level problems including many component parts or sub-problems

1.4 Designing or developing

1.4.1 Design

Dictionary definition: a mental plan. This implies the use of the imagination. A preliminary sketch for a building or a machine. Develop: To take something from the latent state to the active state hence development which means a gradual unfolding. So the design or development of a solution is the process of taking something that has been conceived in the imagination and taking it from that latent state through a process of unfolding into an active or concrete state in material reality.

1.4.2 Definition of Engineering Design

The definition of “Engineering design” as taken from the IEA glossary of terms is as follows:

It is the systematic process of conceiving and developing materials, components, systems and processes to serve useful purposes. Design may be procedural, creative or open-ended and requires application of engineering sciences, working under constraints and taking into account economic, health and safety, social and environmental factors, codes of practise and applicable laws.

1.5 Solutions

1.5.1 Solution

Explaining or dissolving - breaking down into smaller particles. Inherent in this definition is the idea of taking something complex and breaking it down into something less complex, making it possible to explain and understand it and thereby resolve the problem.

1.5.2 The IEA definition

The IEA definition is that a solution is an effective proposal for resolving a problem, taking into account all relevant technical, legal, social, cultural, economic and environmental issues and having regard to the need for sustainability.

Therefore, to design and develop a solution to a complex engineering problem we need a systematic creative process that is applied to a problem that has many levels or layers and takes into account a number of factors so as to produce an effective resolution to the problem. This then takes us to the content of section 2 that uses the assessment criteria as a systematic practical set of steps to achieve this end.

GROUP DISCUSSION

Each group of six candidates are to select a fictitious complex engineering project (e.g. sending a manned spacecraft to Mars) and identify the five aspects presented in section 1. Each group will then demonstrate, in a 5 minute presentation, to another group at the workshop, using only a flip chart, how each aspect is present in the project selected. (Total time allocated for this exercise is 50 minutes.)

INITIAL TEST

Complete the Initial Test in Appendix 1 (10 minutes are allocated for this).

SECTION 2

PRACTICAL DESIGNING OR DEVELOPING MODEL

LEARNING OUTCOMES:

- Understand the practical steps to be taken when designing or developing solutions
- Be competent in using the steps to design and develop solutions
- Be prepared to apply this process in the workplace on a regular and routine basis

2.0 A PRACTICAL DESIGNING OR DEVELOPING MODEL

2.1 Introduction:

This section will take you through the steps of the assessment criteria which form the basis of a practical model. These can be effectively used on an on-going basis when designing and developing a solution to a complex engineering problem.

Funny introduction to problem solving:
http://www.youtube.com/watch?v=RTxAx98qOrg

2.2 Steps in designing or developing solutions:

STEP 1: Analyse the design/planning/solution requirement and draw up detailed requirements specifications

Analyse: This means to examine the detailed constitution (what it is made up of) of the requirements to find their essence and structure. The analysis needs to be detailed and clear using standard accepted engineering terminology and systems to ensure a thorough understanding.

Doing this *analysis* will be an iterative process, meaning that it will be circular in nature and continue to cover ground already considered over and over again until all the relevant information has been established. This is due to the fact that establishing certain information may result in changes to information gathered earlier resulting in a review of earlier requirements.

Choose a *methodology* with well-defined steps to isolate the general statements from the detailed specifications that will be the contents of the requirements specification document. The methodology should lead from the general to the particular and include input from all stakeholders who may have an impact on the satisfactory resolution of the problem.

To this end it is necessary to be clear about the difference between *requirements* and *specifications.* A requirement may be expressed in non-engineering terms often taken from everyday language and from a layman's perspective, whereas a specification will be in specific engineering terms using international symbols, systems and conventions.

A *requirement* such as "Build an Effluent Treatment Plant to prevent pollution of the river" would need to be broken down into the detailed *specification* of the final detailed statement that would indicate the solution to the problem. The final temperature, ph levels and chemical composition of the effluent would be part of the required specifications. At this stage the exact process and method of achieving these parameters is not required as there may be a number of solutions to the problem, each having their own pros and cons. (This case study will be used later during the group exercise to expand and develop the process of establishing specifications for the solution requirement. Discipline-specific case studies will be used by the facilitating mentor and may differ during the workshop presentation from the example given above.)

The *requirements specification* will be the foundation document to which all possible solution options are referred to, so as to confirm that the solutions are in line with the fundamentals of the specifications and do not provide outcomes not required or others that fall short of hitting the target.

(http://www.fb9dv.uni-duisburg.de/se/de/education/ws0405/embedded/terminology.pdf)

STEP 2: Synthesise a range of potential solutions to problem or approaches to developing a solution

During step 1 a clear specification of the problem was developed and now we need to document all the potential solutions based on the requirements of the specification. This will require an imaginative open-minded approach so as to allow all possible options to be presented. It is not the time to rule out any possible solution to the problem, but the time to consider any idea or suggestion. Often what may not appear at first to be an option may have hidden the germ of a simple but effective solution.

List all the possible solutions to the problem. Do not rule out any suggestions at this stage. Keep an open mind. To use a well-worn but useful cliché: "...think outside the box". This step is about getting anything and everything that could possibly present a solution out in the open, on the table, for future evaluation. This is not the time to jump to conclusions about the solution.

Having said the above, this process may not always be linear so once again it can be considered an iterative process that will circulate back on itself time and time again until all ideas and approaches have been covered and all possible solutions have been presented.

During this step all the possibilities will be considered and then synthesised into a number of workable options.

This is the step where all the tools available such as "brainstorming" and "mind mapping" and the use of the human imagination are used in a creative manner to produce as many possible approaches to the solution of the problem as possible.
This is not the time to try and narrow down to any particular solution and the temptation to do so at this stage must be strongly resisted.

(http://www.teachengineering.org/engrdesignprocess.php)
(http://en.wikipedia.org/wiki/Heuristic)

STEP 3: Evaluate the potential approaches against requirements, including cost, and impacts outside requirements

Once the process in step 2 has been completed and a number of options have been identified then each option needs to be evaluated. For example, the problem of supplying electricity for the needs of "The Republic of South Africa" may have been narrowed down to three options; Nuclear Power, Coal Fired Power and Solar Power. This is the step when each of these options would be evaluated against the requirements set in step1.

It is at this point that we need to get down to details about what the relative costs of each solution would be and the impact that each solution would have. As a "Competent Professional" we cannot present a solution that does not take into account the costs as financial resources are always limited. We also need to take into account what the impact on the population would be from the perspective of health, safety and environmental considerations as well as any other legal and societal implications.

It is very important and necessary during this step to take into account all affected and interested parties and stakeholders in the project so as to get the maximum input at an early stage of the process.

With all the factors taken into consideration and as much information gathered and considered for each option isolated in Step 2, a decision must now be made as to which option will be chosen as the most suitable solution to the problem. This is a process of careful consideration of all the information presented and the impacts in all the areas investigated.

(http://www.pitt.edu/~groups/probsolv.html)

STEP 4: Present reasoned arguments and proposal for preferred option

Once one of the options has been selected and becomes the “preferred option” reasoned arguments need to be presented to justify the selection of that particular solution to the problem.

During this step of presenting the “reasoned arguments”, reference should be made to all the facts and information collected in Step 3 so as to maintain a flow of logic and to keep the process consistent.

All the information is needed at this stage in order for one to convince the client that, having taken all factors into consideration, this is the best solution to the problem.

GROUP ACTIVITY

Case Study:

Split into two groups, Group A and Group B.

The problem for which a solution needs to be found is as follows:

A textile mill produces 150000 kl of effluent each month and discharges it into a nearby river. The pollution levels need to be reduced.

Both groups are to write down the problem solution requirements in general/layman's terms as they perceive it. This should take about 15 minutes.

Each group now needs to submit their general requirements to the other group and both groups now need to establish the specifications for the problem solution in more specific engineering terms. The time allowed for this to be done is 30 minutes.

Example of an Effluent Treatment Plant
http://www.youtube.com/watch?v=f6Uu8CpOn-0

STEP 5: Fully develop design of selected option

Once a specific solution has been accepted this option must be fully developed. It is during this stage that all the details relating to the solution are gathered, models developed and calculations done to get down to the specific details. All information related to the specific solution is collected and identified and fully developed and clarified.

It is important at this stage to organise the storage, filing and collection of information in such a way that it is easily retrieved when required during the process of fully developing the design.

The development of the design will employ a variety of technical techniques and methodologies related to the specific requirements of the specific solution, and may require the use of specialists. It is at this point that the engineer must decide if his or her competencies are adequate and if not, to select a person who is competent in the given specific area so as to ensure that the design is properly done and all aspects of public interest are taken into account.

STEP 6: Evaluate resulting solution

Upon completion of the full development of the selected option the solution needs to be evaluated for effectiveness. A full review of the problem statement is made and the solution compared to the initial requirements to ensure that the problem specification has been matched and the solution is effective.

It may be necessary to run models or pilot plants of the proposed solution in order to determine the effectiveness of the solution for a thorough evaluation. This option should at this stage be prepared if required.

STEP 7: Produce design documentation for implementation

This step is the final step of the solution process and should only be undertaken once all the previous steps are completed. It is often very tempting to jump ahead to step 7 when some clarity appears in the process, but it is very important to ensure that the process of going through steps 1 to 6 has been done so as to ensure thoroughness and selection of the best solution.

In reality this will not be a simple linear process and it may circle back and forward through the steps so discipline must be applied to ensure that each step is properly covered.

Final design documentation follows when all the necessary modelling, calculating and evaluating have been done and all parties are satisfied that the solution prescribed will meet the requirements of the problem specification. All the details of the solution are documented, the assumptions and basis for all calculations clearly indicated, and drawings and equipment specification sheets provided. Any social, legal or ethical process required must be specified and the required documents and procedures presented.

Design documentation may be in the form of component, system or process specifications, either in hard or electronic copies as appropriate to the situation, giving sufficient information to allow for the manufacture, modification or installation of the solution by a third party.

ASSESSMENT TEST

Complete the Assessment Test in Appendix 1 (30 minutes are allocated for this).

GROUP ACTIVITY

Topics for small group activity:

Select one of the topics below and spend 45 minutes going through the developing solutions process as outlined above.

1. Public transport in South Africa
2. Energy supply for the future in South Africa
3. Health Care - Public or Private
4. Provision of housing for all South Africans
5. Collection of funds to maintain roads in South Africa

CLASS DISCUSSION

Discuss Case Studies (Appendix 2) and Programme administration.

SECTION 3

GENERIC GUIDING PRINCIPLES

GENERIC GUIDING PRINCIPLES

1. Competency Standard

The SAIMechE Competency Standard is the fundamental document underpinning the journey to Professional Competence. It is the foundation document informing all aspects of the training programme that relates the requirements of competency to the working environment of the developing engineer. It is the standard of practice against which all activities of a competent and professional engineer is measured.

2. Outcomes

The eleven outcomes are the fundamental building blocks on the path to competency. A demonstration of understanding of these outcomes as they relate to the day-to-day working environment will indicate that a level of competency has been reached which will enable the candidate to function at a professional level within the commercial and business environment.

3. Assessment Criteria

The assessment criteria are the requirements against which the candidate is evaluated in order to determine understanding and competency. These are objective criteria which will ensure capability and transparency and set a standard that ensures a proficient level of competency and professionalism as required by industry and in the interests of public health and safety.

4. Range Statements

The range statements set the boundaries of the requirements of each outcome and determine the limits of competency as required for professional practice.

APPENDICES

APPENDIX 1: ASSESSMENTS/TESTS/EVALUATIONS

INITIAL TEST (SECTION 1)

(Individual optional choice)

	Yes	**No**
1. Engineering is basically focused on research and is not practical		
2. Scientific principles are fundamental to engineering		
3. Problems require the use of imagination and creativity		
4. Problems are seldom encountered in engineering		
5. Complex problems do not have many aspects to consider		
6. Complexity may require in depth evaluation		
7. Solutions to complex problems can be simple		
8. Solutions to problems may involve many disciplines		

9. Developing solutions is a systematic process		
10. The first idea for a solution that comes to mind is always the best		

(Candidates to mark each other's answers.)

ASSESSMENT TEST (SECTION 2)

1. Close all manuals and documents on your desk and write down in your own words, in no more than five lines, the 7 steps of the practical developing solutions model. Leave three lines between the end of your answer to each step before you continue to write down the next step.
2. When you have written out each step in your own words open your manuals and write the steps out in the space left below each step as per the assessment criteria.
3. Hand your work to another member in your group and ask them to make an assessment of how close your wording is to the assessment criteria. Do the same for your partner and give them a mark out of 100.
4. Discuss with each other why you have given the marks assigned.

APPENDIX 2: CASE STUDY (SECTION 2)

The problem for which a solution needs to be found is as follows:

A textile mill produces 150000 kl of effluent each month and discharges it into a nearby river. The pollution levels need to be reduced.

Both groups are to write down the problem solution requirements in general/layman's terms as they perceive it. This should take about 15 minutes.

Each group now needs to submit their general requirements to the other group and both groups now need to establish the specifications for the problem solution in more specific engineering terms. The time allowed for this to be done is 30 minutes.

Example of an Effluent Treatment Plant
http://www.youtube.com/watch?v=f6Uu8CpOn-0

REFERENCES

Interesting websites for further study

http://www.youtube.com/watch?feature=player_detailpage&v=dzOoF4gptVQ

http://en.wikipedia.org/wiki/Wicked_problem

http://www.technologystudent.com/designpro/problem1.htm

http://www.triz-journal.com/archives/2007/04/05/

http://www.coe.montana.edu/ie/faculty/sobek/career/asee04_1331.pdf

Interesting books for further study

Discussion of the Method: Conducting the Engineer's Approach to Problem Solving (Engineering & Technology) by Billy Vaughn Koen

TRIZ: Design Problem Solving with Systematic Innovation by Helena V. G. Navas

Engineering Problem - Solving 101: Time-tested and Timeless Techniques by Robert Messler

RECORDING OF REPORTS

Formats for recording the portfolio of evidence

During the course of the candidate phase training, the Candidate will accumulate a portfolio of evidence comprising the reports supporting the various exercises covered in these guidelines for each Outcome.

Note that the PDP Administration will provide a web site document system that will allow the candidate to store all the PDP documents created as a back-up facility and will enable the candidate to allow access by the Mentor for any reviews that are required.

ASSESSMENT PROCESS

Guide to the Candidate

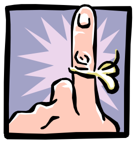
You will be assessed against Outcome 2.

In order to determine your level of competence you will be tested by:

- Tests done during the workshop and evaluated by fellow candidates and your mentor
- Written assignments (practical tasks given to demonstrate understanding of this Outcome through application in a work setting)
- Knowledge assessment and presentation (i.e. 10 minutes oral presentation using Power Point). Please Note: Oral presentations may need to be taped for moderation and re-assessment procedures.

You will need to prepare yourself in the following ways:

- Familiarise yourself with the contents of this guideline
- Familiarise yourself with the reporting formats required
- Familiarise yourself with the references listed
- Do the written assignments as required by this workshop
- For oral presentations of reports, a ten minute presentation is required to summarise the exercise performed



Note:

A detailed briefing on the exact requirements was given to you by the Mentor/Assessor at the Introductory Workshop in order for you to prepare for the assessment process.

The evidence you will be judged on includes:

- Your proven competence in all areas questioned in the presentation (Competent or Not Yet Competent)
- The practical tasks compiled in your Portfolio of Evidence

Good luck, and remember, the mentor/assessor is there to help you.