Unit 104 Engineering perspectives and skills

Unit summary
This unit is about the development of perspectives and skills required to achieve success as an engineer.

Aims
This unit aims to develop the technical and non-technical skills essential to the professional engineer in a period of fast moving technological change. Included are communication and presentation skills essential in the world of work.

Prerequisites
Elementary knowledge of the SI. system of units.

Basic use of tables and graphs.

Learning outcomes
There are **six** outcomes to this unit. The candidate will be able to:

- Define the characteristics and responsibilities of professional engineers
- Understand the function, philosophy and process of engineering design
- Use appropriate engineering communication methods
- Use appropriate planning and evaluation methods for engineering projects
- Understand the basic aspects of computation and their application in engineering
- Solve engineering problems using mathematical modelling and simulation techniques

Guided learning hours
It is recommended that 300 hours should be allocated for this unit. 120 of those hours are actual taught hours. This may be on a full time or part time basis.

Key Skills
This unit contributes towards the Key Skills in the following areas:

N4.1
Develop a strategy for using application of number skills over an extended period of time.

N4.2
Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required in work involving:

- deductive and inferential reasoning;
- algebraic manipulation.

N4.3
Evaluate your overall strategy and present the outcomes from your work, including use of charts, diagrams and graphs to illustrate complex data.

PS4.1
Develop a strategy for using skills in problem solving over an extended period of time.

PS4.2
Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required when tackling **one** complex problem with at least three options.

PS4.3
Evaluate your overall strategy and present the outcomes from your work using a variety of methods.

C4.1
Develop a strategy for using communication skills over an extended period of time.

C4.2
Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required in work involving:

- **one** group discussion about a complex subject;
- **one** extended written communication about a complex subject.

C4.3
Evaluate your overall strategy and present the outcomes from your work, using at least **one** formal oral presentation, including the use of two images to illustrate complex points.

IT4.1
Develop a strategy for using IT skills over an extended period of time.

IT4.2
Monitor progress and adapt your strategy, as necessary, to achieve the quality of outcomes required in work involving the use of IT for **two** different, complex purposes.

IT4.3
Evaluate your overall strategy and present the outcomes from your work using at least **one** presentation, showing integration of text, images and number.

Occupational Standards
This unit has been mapped to the following National Occupational Standards:

1.1.1 Identify the requirements of clients for engineering products or processes
1.1.2 Produce specifications for engineering products or processes
1.2.1 Identify and define areas of research
1.2.2 Develop a research methodology
1.3.2 Evaluate the results of research
1.4.1 Establish a design brief for engineering products or processes
1.4.2 Develop a strategy for the design process
1.4.4 Evaluate designs for engineering products or processes
2.1.1 Determine the production requirements of engineering products and processes
2.2.2 Solve production problems with engineering solutions
2.3.1 Monitor the production process
3.2.2 Solve installation problems with engineering solutions
4.3.1 Monitor operational processes
5.1.3 Schedule maintenance activities to implement the maintenance methods and procedures
5.2.2 Solve maintenance problems with engineering solutions
6.1.1 Analyse the risks arising from engineering products and processes
6.2.1 Assure the quality of engineering products or processes
6.2.2 Identify the reasons for quality assurance problems
7.1.1 Develop objectives for projects
7.1.2 Plan the delivery of projects
7.2.1 Establish project management systems
8.1.1 Maintain and develop own engineering expertise

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Outcome 1 Define the characteristics and responsibilities of professional engineers

Knowledge requirements
The candidate knows how to:

1 define professionalism

2 assess the type and level of qualification relevant to
- a technician engineer
- b incorporated engineer
- c chartered engineer

3 understand the role of professional bodies in
- a maintaining levels of competence in engineering
- b maintaining best practice
- c influencing industrial practices
- d developing forums for ideas and debates
- e acting as a technical information source

4 assess the responsibility of the engineer in society
- a developing new products
- b managing pollution to the environment
- c generating national wealth
- d managing finite resources

5 assess the desirable characteristics of a professional engineer
- a combination of logic and flair
- b analytical approach to problems
- c inventive and resourceful
- d mathematically competent
- e adept communicator

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Outcome 2 Understand the function, philosophy and process of engineering design

Knowledge requirements
The candidate knows how to:

1 identify the main steps in the design process

2 describe appropriate models of the design process and the various stages from design concept to presentation

3 describe the nature and role of different types of model in engineering design

4 use computer design packages

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Outcome 3 Use appropriate engineering communication methods

Knowledge requirements
The candidate knows how to:

1 communicate engineering ideas and solutions using
   a sketches
   b drawings
   c diagrams
   d models
2 produce engineering drawings using
   a first and third angle
   b drawing conventions and symbols
   c dimensioning
   d tolerancing
3 represent systems using
   a block diagrams
   b flow charts
   c logic networks
4 write technical reports using appropriate methods, structure and content
5 present technical information in a suitable form for meetings, seminars, video conferencing and publication
6 address an audience using presentation skills and techniques appropriate to the situation

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Outcome 4 Use appropriate planning and evaluation methods for engineering projects

Knowledge requirements
The candidate must know how to:

1 use project evaluation and review techniques (PERT)

2 control projects by applying critical path methods (CPM)

3 evaluates projects using discounted cash-flow techniques (NPV and IRR)

4 identify the major factors in risk analysis and its management

5 present business data using a balance sheet and basic financial accounting techniques

6 implement decision processing taking account of uncertainty

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Outcome 5 Understand the basic aspects of computation and their application in engineering

Knowledge requirements
The candidate knows how to:

1 input and output computers

2 use high and low level computer languages

3 write basic in-line code in a high level computer language

4 use structured programming

5 operate a computer using

- a word processing
- b spread sheets
- c databases
- d graphics

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Outcome 6 Solve engineering problems using mathematical modelling and simulation techniques

Knowledge requirements
The candidate knows how to:

1 use appropriate mathematical modelling techniques

2 use appropriate simulation techniques

3 use numerical methods to differentiate, integrate, solve equations and to fit curves

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Recommended reading list

Core texts	Author(s)	Publisher	ISBN
Engineering Design: A Materials and Processing Approach Chapters: 1 to 7, 10, 11, 13, 14, 17	Dieter	McGraw Hill 3rd edition	007366136-8
The Engineering Design Process Chapters 1 to 3,5,7 and 9 to 11	Ertas, Jones	John Wiley	0471136999
Engineering Drawing: With Applications in CAD Chapters 1 to 8, 10 to 13, 19	Ostrowsky, Arnold	Butterworth-Heinemann	0340706023
Engineers in Business-The Principles of Management & Product Design Chapters 1 to 3,5 to 8,11 to 12	Lanigan	Addison-Wesley	0201416956
Introduction to Computing for Engineers	Chapra, Canale	McGraw Hill	0071138897
Numerical Methods for Engineers Chapters 1,3 to 10	Ayyub, McCuen	Prentice Hall	0133373614
Computing Essentials 2007	T O'Leary L O'Leary	McGraw Hill	077110711-8
Applied Numerical Methods with MATLAB for Engineers and Scientists	S C Chapra	McGraw Hill	007115156-7
Other useful texts			
Design and Manufacture Chapters 1 to 3, 5, 14 to 17	Black, Palgrave		0333609158
Effective Speaking	Turk	Spon Press	0419130306
Effective Writing	Turk, Kirkman	Spon Press	0419146601
Introduction to Engineering Chapters 1 to 8	Wright	John Wiley	0471579300