Arrangements for:

National Certificate in

Engineering Systems at SCQF level 6

Group Award Code: G9CC 46

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Acknowledgement

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of National Qualification Group Awards.

History of changes

It is anticipated that changes will take place during the life of the qualification, and this section will record these changes. This document is the latest version and incorporates the changes summarised below.

Version number	Description	Date
07	**Addition of Units:** F5KB12 Engineering Dimensional and F5W711 Engineering Dimensional Control has been added to the framework as optional units	11/09/23
06	**Addition of Unit:** F5K5 12 Engineering Design has been added to the framework as an optional unit	12/09/22
05	**Addition of Unit:** F5H6 12 Robotic and Automated Systems has been added to the framework as an optional unit.	16/05/22
04	Five practical units added as a cluster to the framework within the Group 2 options where 0 – 1 (no more than 1) can be chosen from the cluster. F5WA 11 Engineering Workshop Skills. F5WD 11 Material Removal Practice: Turning. F5WC 11 Material Removal Practice: Milling. F5JJ 11 Practical Electronics. F5HP 11 Electrical Wiring Skills.	10/04/19
03	Additional unit added to the group 2 option section of the award Engineering Project: F5D5 12	23/03/16
02	Codes changed from: F6XA 11, F6XB 11, F6XC 11 **to FM3C 11, FM3D 11, FM3E 11** respectively.	10/08/11

Contents

1 Introduction

This is the Arrangements Document for the new Group Award in Engineering Systems, at SCQF level 6, which was validated in March 2009. This document includes: background information on the development of the Group Award, its aims, guidance on access, details of the Group Award structure, and guidance on delivery.

The new award has been designed to replace the following current National Certificate Group Award which finishes on 31 July 2011.

National Certificate in *Multi Discipline Engineering* G6M6 04

2 Rationale for the development of the Group Award

This National Certificate (NC) with the title of Engineering Systems is the replacement for the recently lapsed NC in Multi-Discipline Engineering (MDE).

The NC in MDE (G6M6 04) was released in 2001 with the incorporation of some process technology Units to make the award fit for the Oil and Gas (OPITO) engineering and operations technicians Modern Apprenticeship (MA). This qualification is dated in its title, structure and content but there remains a strong requirement for a suitable replacement. Interest in the existing NC MDE has also been expressed by international SQA centres to use as part of their technician training programmes. The existing NC MDE lapsed in July 2008 with an end date of July 2011.

Without replacement of the NC MDE, this would leave the OPITO Oil and Gas technician apprenticeship programme without a suitable SQA NC. As the OPITO MA goes UK-wide from September 2009 as part of the national UK Oil and Gas Academy, it is essential that SQA have a suitable replacement NC to maintain their presence within this market.
The NC in Engineering Systems has attracted keen interest from the HNC/D Engineering Systems Qualification Support Team to provide a feeder qualification for their HNC. SQA Oil and Gas are also in need of NC in Engineering Systems as a feeder to the Petrochemical HNs as well as to continue to service the needs of SQA's international oil and gas centres.

The development of the NC in Engineering Systems will be able to take advantage of Units developed for the new NC Engineering suite of awards.

In providing a replacement NC for the OPITO apprenticeship, the NC in Engineering Systems award represents economic contribution to the UK Oil and Gas business. In facilitating progression to HN and then to degree level studies, the NC in Engineering Systems provides a progression path to higher qualifications and consequential better career prospects. This also clearly has a benefit to Scotland's economy.

In summary, this development strongly supports the Skills for Scotland agenda, particularly in respect of a foundation apprenticeship programme, while also providing SQA with a sound product for use both home and abroad. It was also necessary to ensure that the new Group Award conforms to the SQA National Qualification Group Awards (NQGA) design principles.

3 Aims of the Group Award

3.1 Principal aims of the Group Award

1 Provide an award that will allow candidates to work now, or in the future, at craft or technician levels in an engineering or process operations environment.

2 Provide an award that creates a route towards meeting the educational requirements for Engineer Technician or Process Technician status.

3 Develop an award so that successful completion will allow candidates to progress to an HNC or HND in an engineering or process operations related subject discipline.

4 Allow candidates to develop knowledge, understanding and skills in *Communication, Numeracy* and *Information and Communication Technology* that underpin and support their studies in engineering and process technology.

5 Allow candidates to develop knowledge, understanding and skills in areas of engineering and process operations which relates directly to the title of the award and to suit their needs for career progression.

6 Allow candidates a degree of specialisation in relevant areas of engineering and process technology to support their progression needs.

7 Allow candidates, on successful completion of this award, to achieve the Core Skills of *Communication, Numeracy* and *Information and Communication Technology* at a level appropriate to the award they are studying. Furthermore, to provide candidates with opportunities to develop the *Problem Solving* and *Working with Others* Core Skills.

3.2 General aims of the Group Award

8 Enhance candidates' employment prospects.

9 Support candidates' career development and Continuing Professional Development.

10 Enable progression within the SCQF (Scottish Credit and Qualifications Framework).

11 Develop learning and transferable skills.

3.3 Target groups

This National Certificate in Engineering Systems at SCQF level 6 is intended for school leavers, adult returners and those in employment. However, the primary focus is different from level 5 awards in that it has been designed to provide a balance of relevant technological principles and practical applications suitable for candidates who wish to work at technician level.

The National Certificate in Engineering Systems at SCQF level 6 can be delivered by full-time, day-release or other part-time modes of delivery (eg block-release, evening class etc). For example, this National Certificate in Engineering at SCQF level 6 may be delivered on a full-time basis to school leavers and adult returners where their delivery may be combined with a suitable SVQ/NVQ, such as Performing Engineering Operations at level 1 and 2 (SCQF level 4 and 5), to provide candidates with opportunities to acquire a wide range of skills and knowledge as part of a pre-apprenticeship programme. This award at SCQF level 6 may also be delivered to candidates in employment to provide underpinning knowledge and skills for a related SVQ/NVQ that they be embarked upon.

3.4 Employment opportunities

The Engineering Systems at SCQF level 6 has been developed to provide the knowledge, understanding and skills for those seeking employment now, or at some future date, as technicians in engineering or process industries. It has been devised to allow centres to give their candidates flexibility in Courses leading to certification of the award either through single discipline topics or along a cross-discipline route. There four prime disciplines embodied within the award structure which are:

- Electrical bias
- Mechanical bias
- Measurement and Control bias
- Process operations

4 Access to Group Award

Admission to the National Certificate in Engineering Systems should be based on a broad approach to candidate selection but, at the same time, should ensure that candidates are chosen who have the potential and ability to complete the award successfully. The following are simply recommendations and should not be seen as a definitive or prescriptive list of entry requirements. Their purpose is simply to give guidance on the selection of candidates.

National Certificates in Engineering at SCQF level 6

- At the discretion of the Principal or Head of the presenting centre for applicants with a different experiential background who could benefit from taking the Course or Units within the Course, eg adult returners, overseas students with relevant work experience
- Mathematics Standard Grade at Credit level or equivalent at SCQF level 5
- Physics Standard Grade at Credit level or equivalent at SCQF level 5
- Technological Studies Standard Grade at Credit level or equivalent at SCQF level 5
- NC Group Award in Engineering at SCQF level 5
- Skills for Work in Engineering at SCQF level 5
- SPA in Engineering at SCQF level 5

Alternative access arrangements

The presenting centre may operate alternative access arrangements in cases where the candidate is convinced that he/she already has the required competences in a given area. These arrangements are as follows:

- Assessment on demand
- Credit transfer
- Accreditation of prior learning
- Relevant work experience

Individual presenting centres will require outlining their systems for each of these as a part of any approval procedure.

The recommended Core Skills entry profile for the National Certificate in Engineering Systems at SCQF level 6 is as follows:

♦ *Communication*	SCQF level 5
♦ *Numeracy*	SCQF level 5
♦ *Information and Communication Technology*	SCQF level 5
♦ *Problem Solving*	SCQF level 5
♦ *Working with Others*	SCQF level 4

5 Group Award structure

The National Certificate in Engineering Systems requires the achievement of 12 credits of which 6 must be at SCQF level 6. It is likely that more than 12 credits will be delivered to full-time Courses being offered in a particular academic year.

The structures of the National Certificate in Engineering Systems at SCQF level 6 are best explained in terms of the block diagram below where it will be noted:

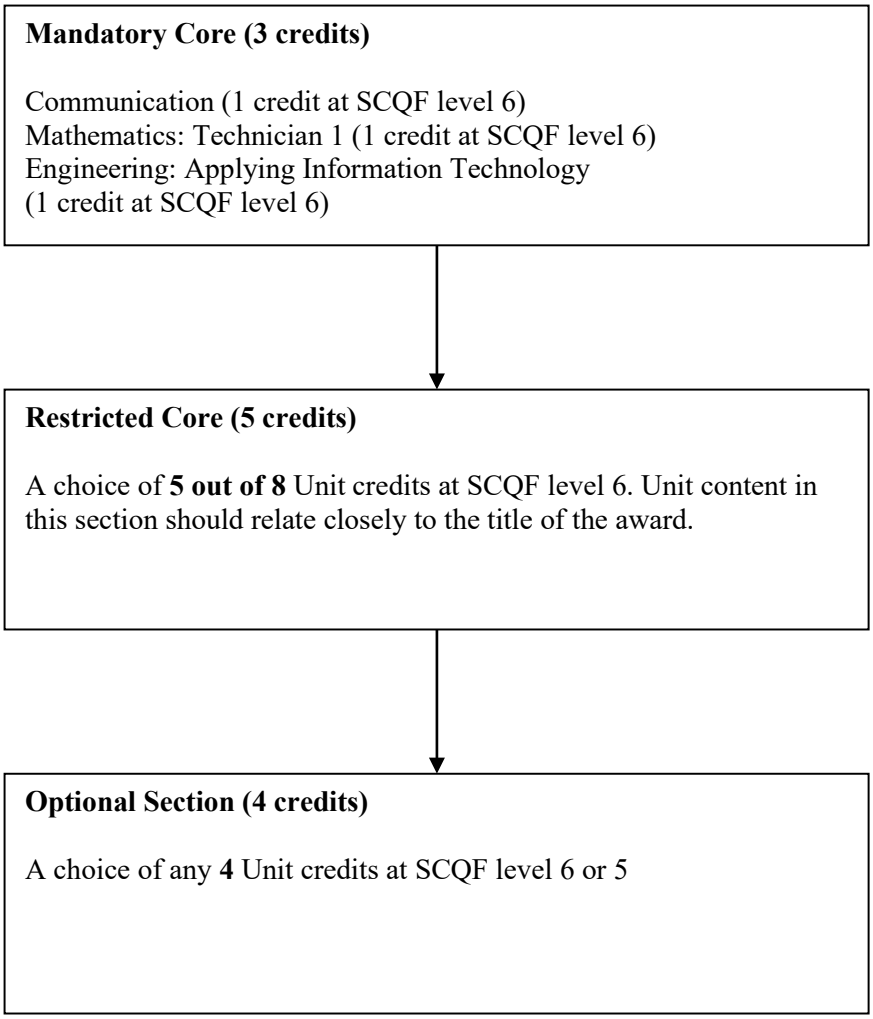
- Award structure at SCQF level 6 comprise of a 3 credit mandatory core, a 5 credit restricted core and a 4 credit optional section

- The *Communication, Mathematics* and *Information and Communication Technology* Units in the mandatory core sections are at the same SCQF level as the level of the award

- The Units in the restricted core sections are at the same SCQF level as the level of the award

- Units in the optional sections can be at SCQF levels 5 or 6

NC in Engineering System and Process Technology — Block Diagram of SCQF level 6 awards


Mandatory Core (3 credits)
Communication (1 credit at SCQF level 6)
Mathematics: Technician 1 (1 credit at SCQF level 6)
Engineering: Applying Information Technology
(1 credit at SCQF level 6)
Restricted Core (5 credits)
A choice of 5 out of 8 Unit credits at SCQF level 6. Unit content in this section should relate closely to the title of the award.
Optional Section (4 credits)
A choice of any 4 Unit credits at SCQF level 6 or 5

5.1 Framework

Conditions of the award

The conditions of award of the National Certificate in Engineering qualifications are as follows:

To achieve a National Certificate in Engineering Systems at SCQF level 6 a candidates must successfully complete the following Units shown in the table below:

- The 3 Unit credits in the mandatory core section
- 5 Unit credits from the restricted core section
- 4 Unit credits from the optional section

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
MANDATORY CORE				
Communication	F3GB 12	6	6	1
Mathematics: Technician 1	F3HX 12	6	6	1
Engineering: Applying Information Technology	F5D4 12	6	6	1
Restricted core				
Engineering Systems	F5FN 12	6	6	1
Engineering Materials	F5KD 12	6	6	1
Mechanical Engineering Principles	F6X7 12	6	6	1
Electrical Principles	F5HL 12	6	6	1
Single Phase and 3-Phase Principles	F5JV 12	6	6	1
Process Measurement and Control: An Introduction	F6X8 12	6	6	1
Graphical Engineering Communication	F5JG 12	6	6	1
Process Chemistry: An Introduction	F6X9 12	6	6	1
OPTION UNITS				
Mechanical cluster				
Engineering Design*	F5K5 12*	6	6	1
Mechanical Engineering Principles	F5K1 11	6	5	1
Statics	F5K8 12	6	6	1
Engineering Dynamics: An Introduction	F5K6 12	6	6	1
Pneumatics and Hydraulics	F5K2 11	6	5	1
Power Drives	F5K3 11	6	5	1
Engineering Thermodynamics	F5JF 12	6	6	1
Thermofluids	F5JE 12	6	6	1
Pipework Systems	F5F9 12	6	6	1

*Refer to History of Changes for revision changes.

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
Electrical/Eectronics cluster				
Electrical Principles	F5HK 11	6	5	1
Fundamental Electronics	F5DB 12	6	6	1
Fundamental Electronics	F5DH 11	6	5	1
Combinational Logic	F5HA 11	6	5	1
Sequential Logic	F5JR 11	6	5	1
Electrostatics and Electromagnetics	F5D3 12	6	6	1
Power Electronics	F5JH 12	6	6	1
Electrical Testing and Measurement	F5HN 12	6	6	1
Electronic Test Equipment and Measurement	F5DJ 12	6	6	1
Rotating Electrical Machines	F5JK 11	6	5	1
Measurement and Control cluster				
Application of PLCs	F5HO 12	6	6	
Engineering: Process Control	F5KK 12	6	6	1
Engineering: Distributed Control Systems	F5KM 12	6	6	1
Engineering: Control Valves and Positioners	F5KL 12	6	6	1
Engineering: Measurement Technology – Flow	F5KR 12	6	6	1
Engineering: Measurement Technology – Pressure/Level	F5KT 12	6	6	1
Engineering: Measurement Technology – Temperature	F5KS 12	6	6	1
Engineering: Fault Finding in Measurement and Control	F5KN 12	6	6	1
Process specific cluster				
Process Operations: Oil and Gas Separation	FM3C 11	6	5	1
Process Operations: Gas Processing Operations	FM3D 11	6	5	1
Process Operations: Utilities	FM3E 11	6	5	1
General cluster				
Mathematics: Technician 2	F3HY 12	6	6	1
Graphical Engineering Communication	F5FP 11	6	5	1
CAD for Engineers	F5H5 12	6	6	1
Plant Maintenance Practice	F5J3 11	6	5	1
Health and Safety: Engineering	F5DG 11	6	5	1
Engineering: Hazards, Protection Methods and Functional Safety	F5KP 12	6	6	1
Engineering Project	F5D5 12	6	6	1
Robotic and Automated Systems	F5H6 12*	6	6	1
Practical cluster				
Engineering Workshop Skills	F5WA 11*	6	5	1
Material Removal Practice: Turning	F5WC 11*	6	5	1

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
Material Removal Practice: Milling	F5WB 11*	6	5	1
Practical Electronics	F5JJ 11*	6	5	1
Electrical Wiring Skills	F5HP 11*	6	5	1
Engineering Dimensional Control	F5KB 12*	6	6	1
Engineering Dimensional Control	F5W7 11*	6	5	1

*Refer to History of Changes for revision changes.

Core Skills Exit profile

The Core Skills Exit Profile for this National Certificate at SCQF level 6 is as follows:

Communication at SCQF level 6 (the *Communication* Core Skills Unit at SCQF level 6 is one of the three Units in the mandatory Core Section of this National Certificate

Numeracy at SCQF level 6 (embedded in the mandatory Unit *Mathematics: Technician 1*)

Information and Communication Technology at SCQF level 6 is embedded in the mandatory Unit *Engineering: Applying Information Technology*

Graphical Engineering Communication at SCQF level 6 has the Core Skills component Using Graphical Information at SCQF level 5 embedded

Problem Solving

All elements of the Core Skill of *Problem Solving* — Critical Thinking, Planning, Organising, Reviewing and Evaluating — underpin the technical competencies developed in the award. As each Unit is undertaken candidates learn to identify, consider and take into account a range of factors impacting on practical engineering work. Specifications are interpreted, and decisions are made on techniques, tools and materials which comply with regulatory and safety requirements. Implementing these effectively includes the ability to adapt and modify approaches as necessary. Inspection and testing provide opportunities for the review and evaluation of achievement, with assessor guidance and feedback**.**

Working with Others

Small group investigative and experimental activities as part of formative work will support candidates particularly those with no industrial experience. All practical learning and assessment tasks will develop team working skills and support the ability to form working relationships in practical vocational contexts. Feedback from assessors on good practise will be on-going. Organised site visits will involve contributing and co-operating in group activities and observation of industry practice.

Further Core Skills development opportunities are identified in each of the individual NQ Unit Specifications.

5.2 Mapping information

How the general aims are met in the NC in Engineering Systems

Aim No.	How it is met in NC Engineering Systems
3.1.1	For many years National Certificates in Engineering and Science have equipped candidates to seek employment in a wide range of industrial, service and public sector organisations. Market research indicates that National Certificates in Engineering and Science are still regarded by many organisations as the minimum qualifications to work at technician level.
3.1.2	There has been a long tradition of candidates in employment taking National Certificates in Engineering and Science on a part-time basis to increase their knowledge and skills in engineering and process applications and, as a result, enhance their career development. It is anticipated in the future that many candidates in employment will study the new National Certificates in Engineering Systems on a part-time basis to enhance their knowledge and skills of engineering and as a consequence improve their career development opportunities. In a similar way candidates studying this National Certificates on a full-time basis at a centre are being provided with the knowledge and skills to pursue a career in engineering or process operations. It is also anticipated that some of the NQ Units in this new National Certificate at SCQF Level 6 may be used for Continuing Professional Development (CPD). For, example, a candidate may decide to choose a Unit, or Units, in Computer Aided Draughting (CAD) to develop new knowledge and skills in this subject area. CPD opportunities may also exist in other subject areas such as Programmable Logic Controllers (PLCs) or Distributed Control Systems.
3.1.3	All Units within this new National Certificate have been leveled at SCQF levels 6. The new awards also conform to the SQA Design Principles for NQGA. Thus, progression within the SCQF for successful candidates is assured.

How the general aims are met in the NC in Engineering Systems (cont)

Aim No.	How it is met in NC Engineering Systems
3.1.4	This new National Certificate in Engineering Systems provide centres with scope to enhance learning skills not least by creating opportunities for candidates to combine technological principles with practical applications to achieve a real understanding of a subject. For example, many NQ Units recommend significant use of practical work and/or computer simulation to reinforce learning. It is also anticipated that centres will use innovative delivery approaches that may make use of laboratory equipment and/or on-line delivery and/or Virtual Learning Environments to enhance candidate learning. Industrial visits are also highly recommended to consolidate learning in the centre. By their very nature, technology Courses require the transfer of technical knowledge and skills from one area to another. For example, candidates may need to apply electrical or mechanical principles learnt in a restricted core Unit to an engineering or process system problem in a specialist Unit. Similarly, mathematics knowledge and skills developed in a core Numeracy or Mathematics Unit may be applied within a restricted core or options Unit. Although not necessarily defined explicitly in individual Units, centres may have opportunities to develop other transferable skills as a part of the delivery and assessment of this National Certificate programme of study. For example, there may be opportunities, particularly in Level 6 awards, to develop candidates' analytical skills while, for example, breaking down an engineering and/or process system in terms of the construction and operation of individual parts of the system. Planning skills may be developed while making preparations for practical work and when undertaking assignments or projects. Practical and project work may also provide candidates with opportunities to develop their evaluative skills. Opportunities to develop employability skills may be incorporated within the delivery of the National Certificates programme. For example, centres may take the opportunity, if only formatively, to assess such skills as time keeping, listening to instructions, checking own work, working with others and general behaviour.

3.4 How the specific aims are met in the NC in Engineering Systems

Aim No.	How it is met in NC Engineering Systems
3.2.1	National Certificates in Engineering and Science have for many years been recognised by employers and other stakeholders of these awards as appropriate qualifications for persons wishing to work at craft and technician levels. Market research (see Section 2.3) indicates that there is still a demand for engineering and process craft/trades persons and technicians. Thus, it is confidently anticipated that a candidate achieving this National Certificates will find employment as a crafts person or technician in a wide range of small, medium or large companies within an engineering or process environment. National Certificates in Engineering and Science at SCQF level 6 have been developed principally for the education and training of technicians.
3.2.2 & 3.2.3	As noted in Section 2.5 a National Certificate no longer fully satisfies the education requirements for technician status. However, the IET has advised that a National Certificate in Engineering qualification partially meets the academic requirements for registration as an engineering technician. Articulation routes between this National Certificates and HNC and HNDs in Engineering and Process disciplines are identified in Table 2.5.
3.2.4	Market research with FE colleges, employers and other stakeholder of National Certificates qualifications have indicated the importance of retaining distinct Units in Communication, Numeracy and Information and Communication Technology in the new awards. The knowledge, understanding and skills contained in these Units are seen as essential to the development of crafts persons and technicians irrespective of which engineering or science discipline they are studying. In terms of the design of the new awards there are common Units in Communication, Numeracy and Information and Communication Technology at SCQF level 6 forming a mandatory core for these qualifications.

How the specific aims are met in the NC in Engineering System and Process Technology (cont)

Aim No.	How it is met in NC Engineering Systems
3.2.5	From an early stage in the development, it was decided that it was important to define the National Certificate in Engineering Systems in terms of a group of Units that closely relate to the title of the qualification, thus making the award distinctive in its own right. This approach has been broadly accepted by those who have been consulted during the development of the award. In terms of qualification design, the National Certificate has a Restricted Core section comprising of Units that link very closely to the title of the qualification. Candidates can choose any five out of eight Unit credits from this section of the qualification.
3.2.6	As is the case in the current National Certificates, each National Certificates in Engineering has an Optional Section in which candidates can choose four Unit credits from a range of engineering Units contained in this section. Thus, candidates have scope to specialise to some degree further in the engineering and process disciplines embraced within this NC they are studying and/or broaden their knowledge, understanding and skills across engineering and process systems. The options section also contains a Unit in Mathematics so that candidates can develop their Mathematical knowledge and skills further with a view to progressing to a more advanced Course.
3.2.7	The Core Skill Unit, Communication at SCQF Level 6 sit within the mandatory core section of the National Certificate in Engineering Systems. Therefore, candidates successfully achieving the award will have also achieved the Core Skill of Communication at the SCQF level of the award. The delivery and assessment of the Communication Unit should be fully integrated into the delivery and assessment of this National Certificate qualification. For example, where candidates have to produce a report as part of an assessment in an engineering or process Unit, the report could also be used for assessment of the Core Skills. Communication skills of candidates taking National Certificates will vary considerably and some candidates will require greater levels of support to improve their Communication skills. Centres should provide each candidate with the level of support appropriate to the candidate's needs so that by the time the candidate has completed their National Certificate he/she can read, write and speak technically at a level appropriate to the National Certificate. The Mathematics: Technician 1 Unit, which is in the mandatory core of this National Certificates in Engineering Systems at SCQF level 6, has the full Numeracy Core Skill at SCQF lLevel 6 embedded in it. Therefore, a candidate successfully completing this National Certificate will achieve the Core Skill Numeracy at SCQF level 6.

Aim No.	How it is met in NC Engineering Systems
	The Core Skill Information and Communication Technology at SCQF level 6 is embedded within the mandatory core Unit Engineering: Applying Information Technology at SCQF level 6. This is subject to Core Skills validation which is scheduled to take place in August/September 2008. Full attention has been given to the development of the other two Core Skills namely, Problem Solving and Working with Others. Opportunities to develop these Core Skills have been identified in individual NQ Units in the award.

5.3 Articulation, professional recognition and credit transfer

Progression and Professional Body requirements

The National Certificates in Engineering Systems has been designed to allow successful candidates to progress to a range of related Higher National awards.

For instance, at the discretion of the delivery centre, the National Certificate in Engineering Systems can provide progression to the HNC and HND awards shown in the table below. The pertinent progression routes for a candidate will, to some extent, depend upon the option Units that the candidate has studied as part of their NC Course.

The Engineering Systems QDT are currently consulting with the Institution of Engineering and Technology (IET) about the status of the National Certificates in Engineering with regard to future membership of the IET. The IET has informally advised that the National Certificates in Engineering only partially meet the academic requirements for registration as an Engineering Technician. A minimum of an HNC or HND in Engineering is required to meet the full academic requirements.

The Engineering Systems QDT is also currently consulting with the Institution of Mechanical Engineers (IMechE) with regard to the status of the new awards and membership of the IMechE. The IMech E has informally advised that the NC awards at SCQF Level 6 will meet the academic requirements of Engineering Technician status.

Progression routes from the new NC in Engineering Systems to related HNC/HND qualifications

This National Certificate will be the prime access route for the following HNC/HNDs:

NC in Engineering Systems	HNC/HND Engineering Systems
	HNC/HND Petroleum Engineering
	HNC/HND Chemical Process Technology

The award will also have the capability to provide access to the following HNC/HNDs:

NC in Engineering Systems	HNC/HND Mechanical Engineering
	HNC/HND Electrical Engineering
	HNC/ HND Measurement and Control Engineering

As noted in Section 2 many of the previous NC modules in Engineering and Science are now dated. Given the changes in technology and working practices over this period it is unlikely that many credit transfer opportunities will exist between these old NC modules and the new NQ Units. Undertaking an exercise to investigate credit transfers opportunities between appropriate old NC modules and the new NQ Units comprising the Engineering Systems award would be a major project involving the commitment of a considerable resource. Such a resource commitment may be difficult to justify in terms of the number of centres seeking information on credit transfer. Thus, it is considered more appropriate to consider each centre's request for credit transfer information on an individual basis as they arise and build up a record of credit transfer decisions as they are made.

Alignment of the NQGA in Engineering Systems with National Occupational Standards

There are currently over two thousand National Occupational Standards available across different Sector Skills Councils to which the new suite of Engineering and Science National Certificates may be mapped. Mapping such a large number of Standards is a very large, resource intensive project. Given the size of this project and with some of the Standards currently under review, it has not been possible to do a full mapping. However, Appendix 1 contains examples of mapping between the new NC award and National Occupational Standards to illustrate how a mapping process should be conducted.

6 Approaches to delivery and assessment

6.1 Content and context

The National Certificates in Engineering Systems at SCQF level 6 has been designed principally to meet the educational and training needs of those candidates who wish to pursue a career as a technician in an engineering or process operations environment.

This National Certificates at SCQF levels 6 has been designed with the following three sections:

- Mandatory core
- Restricted core
- Optional

From the beginning of the development of this National Certificate, market research evidence pointed clearly to the inclusion of three common mandatory Units in *Communication, Mathematics* and *Information and Communication Technology*. It is important that these mandatory core Units are not delivered in isolation but rather their delivery and assessment is integrated fully with the other Units in this award. For example, experience shows that teaching mathematics within an engineering or process operations context helps candidates to grasp more effectively important numerical and mathematical concepts, formulae and problem solving approaches. Likewise *Information and Communication Technology* has more relevance to candidates when it is set within a physical applications context. For this reason, the Units *Engineering: Applying Information Technology* at SCQF level 6 has an Outcome where candidates have to use and apply engineering or process software.

Experience has shown that centres have faced many challenges when delivering and assessing Communication within some technology-based programmes of study. Candidates struggle to see the relevance of Communication when it is taught in isolation of the rest of a technology based Course. This issue has been addressed by including the Core Skill Unit in *Communication* at SCQF level 6 within the National Certificates in Engineering Systems at SCQF level 6. In doing this it is hoped that centres will endeavour to deliver and assess the Core Skills in *Communication* at appropriate points within the delivery of engineering and/or process technology Units. For example, an activity within an engineering Unit which requires candidates to engage in group discussions provides lecturers with opportunities not only to develop the candidate's technical skills but also their oral communication skills. Likewise report writing in engineering or process technology Units should provide opportunities to develop important written communication skills.

The restricted core section of the National Certificate in Engineering Systems has been designed to reflect as closely as possible the title of the award and as such it is this section that defines the unique nature of the award. This is clearly recognisable from the following list of eight restricted core Units of which 5 must be selected for this National Certificate:

- *Engineering Systems*
- *Engineering Materials*
- *Mechanical Engineering Principles*
- *Electrical Principles*
- *Single Phase and 3-Phase Principles*
- *Process Measurement and Control: An Introduction*
- *Graphical Engineering Communication*
- *Process Chemistry: An Introduction*

The options sections of the National Certificates in Engineering Systems are designed to allow candidates some degree of flexibility in the choice of Units they study as part of their National Certificate programme. Candidates may select Units from this section for one or more of the following reasons:

- to specialise further in a particular engineering or process discipline defined by the title of the award
- to broaden their knowledge of engineering and process technology
- to enhance their knowledge and understanding of Numeracy/Mathematics so that they can progress to more advanced qualifications
- to meet the requirements of their employer
- for career and/or personal development purposes

Mapping of Health and Safety references through the award framework

Candidates for this award will either be currently working in the engineering or process industries, or have aspirations to work in these industries in their near future. Consequently, a sound foundation of health and safety practices and knowledge of individual's responsibilities in the workplace is imperative as they prepare for careers in safety critical industrial environments.

It is strongly recommended that the delivery of NC Engineering Systems takes every opportunity to raise candidate's awareness of Health, Safety and Environmental issues relevant to industrial applications. Wherever possible and relevant within the delivery of the programme, the identification of hazards, assessment of risk and adherence to safe working practice should be emphasised. This will be achieved in conjunction with the delivery of any or all of the engineering and technology Units comprising NC Engineering Systems by relating the context of each Unit to pertinent applications and emphasising the associated health and safety implications.

Two specific Units within the award framework are available to provide delivery centres with the opportunities to give candidates separate certification of achieved Health and Safety knowledge and skills. One of these Units focuses on general knowledge and skills aspects for application in an engineering workplace while the other Unit is specifically relevant to flammable environments and equipment functionality. If either of these Units is selected as part of an NC Engineering Systems programme, they should be delivered in a context to complement the selected restricted core and options Units.

All of the Units contain relevant elements and emphasis of Health and Safety for example within the restricted core section.

Unit title	**H & S context and emphasis**
Engineering Systems	Particular reference to compliance with safe working practices within Evidence Requirements for Outcomes as well as in support notes.
Engineering Materials	Particular reference to safe working practices in one Outcome as well as in the support notes.
Mechanical Engineering Principles	Particular reference to safe working practices in one Outcome as well as in the support notes
Process Measurement & Control: An Introduction	Particular reference to related safe working practices in one Outcome as well as in the support notes.
Process Chemistry: An Introduction	Particular reference to health and safety related aspects in the support notes.

Specific Health & Safety Units with the framework:

Unit title	**H & S context and emphasis**
Health & Safety: Engineering	General applications within an engineering environment emphasising: ♦ Responsibilities of employers/employees ♦ Application of safe working practices ♦ Risk assessment
Engineering: Hazards, Protection Methods and Functional Safety	Application of specifications applications within a particular working environments emphasising: ♦ Flammable atmospheres ♦ Risk control via permit to work ♦ Functional safety of equipment

6.2 Delivery and assessment

Delivery

The new National Certificate in Engineering Systems can be delivered by a range of different delivery modes. For example, it may be delivered on a day-release, block-release or evening class basis to candidates in employment. Alternatively, they may be delivered on a full-time basis to school leavers and adult returners. Appendix 2 outlines some indicative programme and delivery sequence alternatives.

Lecturers may use a variety of teaching and learning approaches in delivering the Units in the National Certificate in Engineering Systems award. These may include lecturing, group work, laboratory exercise, practical work, computer simulation (using appropriate software packages), investigative work (including the use of the internet), project work and case studies. The use of open and distance learning and on-line materials may help to supplement and support the learning that takes place in the classroom, laboratory or workshop.

Industrial visits are strongly encouraged wherever possible to allow candidates to see examples of engineering and process systems in operation and to observe the application of principles and practices in 'real' engineering and process operations environments.

Centres, working on their own or in partnership, might also wish to consider the following approaches to delivering the National Certificate in Engineering Systems award:

- Development or purchase of paper based and/or electronic candidate learning support and assessment materials for individual NQ Units
- Identification and sharing of good candidate learning support materials on the internet
- Identification of various sources of information, including those found on the internet, to allow candidates to undertake more in-depth investigations in given subject areas
- Development of on-line Unit assessment materials
- Use of e-mentoring arrangements to support candidates who study at a distance

Centres should take account of information contained in the 'recommended entry' statement in each NQ Unit specification in sequencing the delivery of Units. For example, it may be deemed necessary that the *Mechanical Principles* Unit at SCQF level 5 is delivered before the *Mechanical Principles* Unit at SCQF level 6; or that the *Process Chemistry* Unit is delivered before any of the Process Operations Units, if they are to be selected.

Time spent on summative Unit assessment has been reduced in order to provide lecturers with more time to deliver Units. Lecturers are encouraged, in particular, to use this additional time to reinforce learning in core engineering and process technology concepts, principles and practices.

Lecturers should also seek opportunities to integrate Core Skills within their teaching and learning programmes. Such opportunities may include, but not be limited to, the following:

Communication	♦ Providing candidates opportunities to develop their oral skills by allowing them to give full answers to questions asked by the lecturer and by giving an oral presentation as part of Unit delivery ♦ Encourage candidates to read extensively on various technical subjects. Discuss reading with candidates to check understanding of subject matter ♦ Developing report writing skills in a number of Units ♦ Allowing candidates to develop their communication skills in group work activities
Numeracy	♦ Reinforce numeracy and mathematical skills when teaching engineering Units ♦ Reinforce using graphical information skills by using and comparing a range of engineering graphical representations (eg in the Units Engineering Systems, Graphical Engineering Communication, Process Control, Process Measurement and Control)
Information and Communication Technology	♦ Develop information technology skills through the application of ICT within engineering and/or process technology applications
Problem Solving Skills	♦ Develop problem solving skills by, for example, exploring different solutions to problems; planning and organising appropriately prior to undertaking practical and project work; reviewing and evaluating different solutions to engineering and process system problems and evaluating the quality of own work
Working with Others	Develop working with others skills through group discussion about an engineering and process system problems/issues and by sharing resources in practical activities

Assessment

From the outset of the development of the National Certificate in Engineering Systems, an appropriate assessment strategy has been put in place. This strategy is as follows:

Aims

The aims of the strategy are to ensure that:

(1) consistent, rigorous and efficient approaches are adopted to the development and administration of NQ Engineering and Process Technology assessment instruments, which satisfy nationally agreed standards.

(2) the assessment load on candidates and staff is sensible and that assessment does not unduly detract from teaching and learning.

(3) as far as possible, reliable and rigorous verification processes are put in place in order to ensure that consistent national standards are achieved in the assessment of all Units comprising this National Certificate.

Objectives

Listed below are the measures that have been put in place to meet the aims:

(1) Develop nationally at least one Assessment Support Pack for the mandatory Units and all of the restricted core Units in the National Certificate award.

(2) Adopt a holistic approach to Unit assessment. The implications of this are that a Unit assessment strategy has been adopted, where possible, to produce a single assessment instrument for the whole Unit. Where this was not possible the assessment strategy seeks to ensure that the minimum number of assessment instruments are required consistent with maintaining agreed national standards.

(3) While not seeking to be entirely prescriptive with regard to the time spent on assessment in NQ Units, it is believed that over assessment should be avoided if assessment in individual NQ Units is no greater than 2 hours.

(5) Actively encourage centres to work in partnership in producing NQ Unit assessment materials, which meet nationally agreed standards, reducing, in turn, the workload on staff in individual colleges.

Ensure that consistent and rigorous internal and external moderation procedures operate for NQ Unit assessment processes. This places a clear responsibility on both centres and the SQA.

As far as has been practical the above objectives have been adhered to when developing Assessment Support Packs.

Assessment Support Materials

Assessment Support Packs are currently being produced for the three mandatory core Units and for all Units in the restricted core sections of the National Certificate in Engineering Systems. These Assessment Support Packs should be available by August 2009 when this new National Certificate will be available for centres to enter candidates.

Formative assessment

Formative assessment should be used throughout the delivery of NQ Units to reinforce learning, build candidates' confidence and prepare candidates for summative assessment. They are part of the learning process.

Opportunities for the use of e-assessment

E-assessment may be appropriate for some assessments. By e-assessment we mean assessment which is supported by Information and Communication Technology (ICT), such as e-testing or the use of e-portfolios or e-checklists. Centres which wish to use e-assessment must ensure that the national standard is applied to all candidate evidence and that conditions of assessment as specified in the Evidence Requirements are met, regardless of the mode of gathering evidence. Further advice is available in SQA Guidelines on Online Assessment for Further Education (AA1641, March 2003), SQA Guidelines on e-assessment for Schools (BD2625, June 2005).

6.3 Open and Distance Learning

Advice on the use of open and distance learning is given in individual NQ Unit specifications where it is considered that these modes of delivery are appropriate. However, where open and distance learning is used due regard must be paid to assessment. Planning would be required by centres to ensure the sufficiency and authenticity of candidate evidence. Arrangements would be required to be put in place to ensure that the assessment or assessments were conducted under the conditions specified in the Unit specification. For example, in the case of a Unit which involved an end test a centre would have to make arrangements for the test to be conducted under controlled, supervised conditions. Likewise, where a Unit involves a practical based assessment, a centre would have to make arrangements for candidates to come into the centre to undertake the assessment under the conditions specified in the NQ Unit specification.

It should be noted that the same requirements as specified in the previous paragraph apply where part or all of a Unit is delivered on-line.

7 General information for centres

Disabled candidates and/or those with additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering whether any reasonable adjustments may be required. Further advice can be found on our website **www.sqa.org.uk/assessmentarrangements**.

Internal and external verification

All instruments of assessment used within this/these Group Award(s) should be internally verified, using the appropriate policy within the centre and the guidelines set by SQA.

External verification will be carried out by SQA to ensure that internal assessment is within the national guidelines for these qualifications.

Further information on internal and external verification can be found in *SQA's Guide to Assessment and Quality Assurance for Colleges of Further Education* **(www.sqa.org.uk)**.

8 General information for candidates

Introduction

The Engineering Systems at SCQF level 6 has been developed to provide the knowledge, understanding and skills for those seeking employment now, or at some future date, as technicians in engineering or process industries. It has been devised to allow centres to give their candidates flexibility in Courses leading to certification of the award either through single discipline topics or along a cross-discipline route. There four prime disciplines embodied within the award structure which are:

- Electrical bias
- Mechanical bias
- Measurement and Control bias
- Process operations bias

Award structure

Award of the National Certificate in Engineering Systems requires the achievement of 12 credits of which 6 must be at SCQF level 6. It is likely that more than 12 credits will be delivered to full-time Courses being offered in a particular academic year.

The National Certificate in Engineering Systems comprises the following three sections:

- Mandatory
- Restricted core
- Options

The **mandatory section** contains three Units in *Communication, Mathematics* and *Information and Communication Technology.* Irrespective of which field of engineering or process operations you wish to go into it is important that you can read and understand technical information, speak to others effectively while working and present technical information in written form in a correct and concise manner, free from spelling and grammatical mistakes. All fields of engineering and process operations involve some use of mathematics for calculations and it is important that you are competent in numeracy and mathematics if you are going to work as a technician. Information technology is also important whether you are using word processing and graphics packages to produce a report or a computer simulation package to model an engineering or process system.

The **restricted core** section of the award contains 8 Units that relate directly to the title of the award. This section really defines the award in terms of the discipline routes embodied within the National Certificate. Five Units must be selected from the restricted core. The following Units comprise the restricted core of this National Certificate from which five must be selected:

- Engineering Systems
- Engineering Materials
- Mechanical Engineering Principles
- Electrical Principles
- Single Phase and 3-Phase Principles
- Process Measurement and Control: An Introduction

- Graphical Engineering Communication
- Process Chemistry: An Introduction

The options section of the National Certificate allows you the flexibility to choose four Units from a range of Units. The choice of Units selected depends on the following factors:

- wanting to focus on engineering disciplines or process operations disciplines.
- wanting to study for a cross-discipline award
- wanting to do additional mathematics because I want to progress to a more advanced Course
- needing to study certain Units to satisfy my employer's needs
- having a career or personal interest in a certain subject, or subjects
- resources available at the delivery centre

Learning and Teaching

While studying the National Certificate in Engineering Systems award, the learning and teaching approaches adopted by your lecturers could include the following: lecturing, group work, practical engineering work, measurement and testing, computer simulation, investigations (including the use of the Internet) and project work. Industrial visits may also be included in your Course to allow you to see 'real life' engineering and process systems in action.

Assessment

SQA has designed this National Certificate award to ensure that assessments meet national standards. Every attempt has been made to optimise assessment so that sufficient time is available for you to learn both the technological principles and practical applications to provide the basis of progression towards full technician level.

Individual Unit assessments will normally consist of practical exercises, written tests, assignments, laboratory work, computer simulations and project work. Your lecturer should tell you at the start of the Unit delivery what form the Unit assessment will take.

Access to the National Certificate in Engineering Systems

Access to this National Certificate is fully inclusive. However for candidates to have a realistic potential of successfully achieving the award, it is recommended that they should be able to meet one of the following criteria:

- Mathematics Standard Grade at Credit level or equivalent at SCQF level 5
- Physics Standard Grade at Credit level or equivalent at SCQF level 5
- Technological Studies Standard Grade at Credit level or equivalent at SCQF level 5
- NC Group Award in Engineering at SCQF level 5
- Skills for Work in Engineering at SCQF level 5
- SPA in Engineering at SCQF level 5
- At the discretion of the Principal or Head of the presenting centre for applicants with a different experiential background who could benefit from taking the Course or Units within the Course, eg adult returners, overseas students with relevant work experience

Alternative access arrangements

The delivery centre may operate alternative access arrangements in cases where appropriate. These arrangements are as follows:

- Assessment on demand
- Credit transfer
- Accreditation of prior learning
- Relevant work experience

Progression

If you successfully complete the National Certificate in Engineering Systems at SCQF level 6 you will be able to progress to an HNC/HND in one of a number of discipline areas developed with the National Certificate such as:

- Engineering Systems
- Petroleum Engineering
- Petroleum Process Operations and Control Technology
- Electrical Engineering
- Mechanical Engineering
- Measurement and Control Engineering

9 Glossary of terms

SCQF: This stands for the Scottish Credit and Qualification Framework, which is a new way of speaking about qualifications and how they inter-relate. We use SCQF terminology throughout this guide to refer to credits and levels. For further information on the SCQF visit the SCQF website at **www.scqf.org.uk**

SCQF credit points: One SCQF credit point equates to 10 hours of learning. NQ Units at SCQF levels 2–6 are worth 6 SCQF credit points, NQ Units at level 7 are worth 8 SCQF points.

SCQF levels: The SCQF covers 12 levels of learning. National Qualification Group Awards are available at SCQF levels 2-6 and will normally be made up of National Units which are available from SCQF levels 2–7.

Dedicated Unit to cover Core Skills: This is a non-subject Unit that is written to cover one or more particular Core Skills.

Embedded Core Skills: This is where the development of a Core Skill is incorporated into the Unit and where the Unit assessment also covers the requirements of Core Skill assessment at a particular level.

Signposted Core Skills: This refers to the opportunities to develop a particular Core Skill at a specified level that lie outwith automatic certification.

Qualification Design Team: The QDT works in conjunction with a Qualification Manager/Development Manager to steer the development of the National Certificate/National Progression Award from its inception/revision through to validation. The group is made up of key stakeholders representing the interests of centres, employers, universities and other relevant organisations.

Consortium-devised National Certificates/National Progression Awards are those developments or revisions undertaken by a group of centres in partnership with SQA.

10 Appendices

Appendix 1: Alignment of NQ Engineering Systems Units with National Occupational Standards
Appendix 2 Indicative sequence of delivery

Appendix 1: Alignment of NQ Engineering Systems Units with National Occupational Standards

- **SEMTA Units: Electrical and Electronic Engineering level 3**
- **OPITO Units: Process Engineering Maintenance level 3**
- **Other Relevant ECITB and SUMMIT Skills Units**

NQGA — Measurement and Control Engineering

Alignment to National Occupational Standards (NOS)

The National Occupational Standards were developed by OPITO and approved in February 2004.

Table 1 indicates SVQ Units used in the mapping exercise.

Table 1

	NOS — Process Engineering Maintenance (Instrument and Control)	
	NOS — Reference	**Unit title**
1	C2.1	Reinstate work area after completing the maintenance of process plant and equipment.
2.	C2.2	Handover Process Plant and equipment
3.	C2.3	Deal with hazards
4.	C2.4	Contribute to effective working relationships in process engineering maintenance.
5.	I 2.1	Carry out planned maintenance procedures on instrument and control plant and equipment.
6.	C2.5	Prepare work areas for the maintenance of process plant and equipment.
7.	I2.2	Prepare materials for the maintenance of instrument and control process plant and equipment.
8.	I2.3	Prepare process plant and equipment in support of instrument and control engineering activities.
9.	C2.6	Prepare loads for moving.
10.	C2.7	Move loads
11.	I 2.4	Assemble components of instrument and control process plant and equipment.
12.	I 2.5	Remove components from instrument and control process plant and equipment.
13.	I 2.6	Replace components in instrument and control process plant and equipment.

NQGA — Measurement and Control Engineering																
			National Occupational Standards													
Unit title	**Core/Option**	**Level**	1	2	3	4	5	6	7	8	9	10	11	12	13	
Communications	Common Core	6	X	X		X	X	X	X	X	X	X		X	X	
Engineering: Applying Information Technology	Common Core	6	X	X		X	X	X			X			X	X	
Maths/Numeracy	Common Core	6		X			X		X	X				X		
Measurement: Technology Flow	Optional	6		X			X		X	X			X	X		
Measurement: Technology Pressure/Level	Optional	6		X			X		X	X			X	X		
Measurement: Technology Temperature	Optional	6		X			X		X	X			X	X		
Process Control	Optional	6		X	X		X		X	X				X		
Programmable Logic Controllers	Optional	6		X			X		X	X				X		
Hazards, Protection Methods and Functional Safety	Option	6	X	X	X	X	X		X	X	X	X	X			
Combinational Logic	Option	6							X				X			
Electrical Fundamentals	Option	6							X							
Project	Option	6		X					X							

NQGA — Electronics levels 5 and 6

Alignment to National Occupational Standards (NOS)

Table 1 indicates Units used in the mapping exercise.

NOS: Electrical and Electronic Engineering level 3

NVQ: 100/4951/4

SVQ: G7PX23

Table 1

Reference number	QCA Code	Title
EEE3/001	Y/101/8210	Complying with statutory regulations and organisational safety requirements
EEE3/002	L/101/7250	Using and interpreting engineering drawings and documents
EEE3/003	R/101/7251	Working efficiently and effectively in engineering
EEE3/006	R/102/9738	Providing technical guidance to others
EEE3/010	Y/102/9742	Selecting and preparing materials and components for manufacturing
EEE3/014	M/102/9746	Processing electronic components within the manufacturing system
EEE3/015	T/102/9747	Checking the compliance of electronic components against the specification
EEE3/017	F/102/9749	Assembling and wiring electronic equipment and systems
EEE3/018	T/102/9750	Testing post-production electronic components and circuits
EEE3/020	F/102/9752	Preparing facilities for testing electronic components and circuits

Electronics level 5 Mapping

Unit title	Core/Restricted core/Option	Level	001	002	003	006	010	014	015	017	018	020
Combinational Logic	Optional	5	√	√	√	√		√			√	√

Electronics level 6 Mapping

Unit title		Level	001	002	003	006	010	014	015	017	018	020
Communications	Common core	6	√	√	√							
Engineering: Applying Information Technology	Common core	6	√	√	√							
Mathematics/Numeracy	Common core	6		√	√							
Electrical Principles	Restricted core	6	√	√	√						√	
Fundamental Electronics	Optional	6	√	√	√	√	√	√	√	√	√	√
Electronic Test Equipment and Measurement	Optional	6	√	√	√				√		√	√
Combinational Logic	Optional	6	√	√	√			√			√	√
Programmable Logic Controllers	Optional	6	√	√	√							
Electrostatics and Electromagnetics	Optional	6	√	√	√							
Power Electronics	Optional	6	√	√	√	√			√		√	

NQGA — NC Electrical Engineering levels 5 and 6

Alignment to National Occupational Standards and Units

Table 1 indicates **SEMTA** Units used in the mapping exercise.

SEMTA Units: Electrical and Electronic Engineering level 3

Table 1

Reference number	Title
EEE3/001	Complying with statutory regulations and organisational safety requirements
EEE3/002	Using and interpreting engineering drawings and documents
EEE3/003	Working efficiently and effectively in engineering
EEE3/006	Providing technical guidance to others
EEE3/026	Assembling rotor and armature windings
EEE3/027	Assembling stator windings
EEE3/028	Assembling and fitting commutators
EEE3/029	Balancing assembled rotors or armatures
EEE3/030	Assembling and fitting electrical rotating equipment
EEE3/034	Carrying out functional tests on electrical equipment
EEE3/035	Locating and diagnosing faults in electrical systems and equipment

NC Electrical Engineering: Level 5 Mapping

Unit title	Core/Restricted core/Option	Level	001	002	003	006	026	027	028	029	030	034	035
Rotating Electrical Machines	Option	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NC Electrical Engineering: Level 6 Mapping

Unit title	Core/Restricted core/Option	Level	001	002	003	006	026	027	028	029	030	034	035
Communications: Core Skills	Core	6	✓	✓	✓								
Mathematics: Technician 1	Core	6	✓	✓	✓								
Engineering: Applying Information Technology	Core	6		✓	✓								
Electrical Principles	Restricted core	6	✓	✓	✓								✓
Electrical Testing and Measurement	Option	6	✓	✓	✓	✓						✓	✓

Alignment to National Occupational Standards and Units

Table 2 indicates **SEMTA** Units used in the mapping exercise.

SEMTA Units: Electrical and Electronic Engineering level 3

Table 2

Reference number	Title
045NEEE3/001	Complying with statutory regulations and organisational safety requirements
045NEEE3/002	Using and interpreting engineering drawings and documents
045NEEE3/003	Working efficiently and effectively in engineering
045NEEE3/006	Providing technical guidance to others
045NEEE3/026	Assembling rotor and armature windings
045NEEE3/027	Assembling stator windings
045NEEE3/028	Assembling and fitting commutators
045NEEE3/029	Balancing assembled rotors or armatures
045NEEE3/030	Assembling and fitting electrical rotating equipment
045NEEE3/034	Carrying out functional tests on electrical equipment
045NEEE3/035	Locating and diagnosing faults in electrical systems and equipment

NC Electrical Engineering: Level 5 Mapping

Unit title	Core/Restricted core/Option	Level	001	002	003	006	026	027	028	029	030	034	035
Communications	Core	5	✓	✓	✓								
Rotating Electrical Machines	Option	5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

NC Electrical Engineering: Level 6 Mapping

Unit title	Core/Restricted core/Option	Level	001	002	003	006	026	027	028	029	030	034	035
Communications: Core Skills	Core	6	✓	✓	✓								
Mathematics: Technician 1	Core	6	✓	✓	✓								
Information Technology for Engineering 2	Core	6		✓	✓								
Electrical Principles	Restricted core	6	✓	✓	✓								✓
Electrical Testing and Measurement	Option	6	✓	✓	✓	✓						✓	✓

NQGA — NC Electrical Engineering levels 5 and 6

Alignment to National Occupational Standards and Units

Table 3 indicates **OPITO** Units used in the mapping exercise.

OPITO Units: Process Engineering Maintenance level 3

Table 3

Reference number	Title
C3.1	Hand over process engineering plant and equipment
C3.2	Reinstate the work area after completing the maintenance of process engineering plant and equipment
C3.3	Minimize risks to life, property and the environment
C3.4	Work safely, minimize risk and comply with emergency procedures
C3.5	Contribute to effective working relationships
C3.6	Prepare work areas for the maintenance of process engineering plant and equipment
E3.1	Carry out planned maintenance procedures on electrical plant and equipment
E3.2	Deal with variations and defects in electrical plant and equipment
E3.3	Diagnose and determine the causes of faults in electrical plant and equipment
E3.4	Prepare equipment in support of electrical maintenance activities
E3.5	Prepare materials for the maintenance of electrical plant and equipment
E3.6	Adjust electrical plant and equipment to meet operational requirements
E3.7	Remove components from electrical plant and equipment
E3.8	Replace components in electrical plant and equipment
E3.9	Determine the feasibility of repair of components from electrical plant and equipment
E3.10	Interpret detailed electrical information from technical sources
E3.11	Read and extract information from electrical engineering drawings and specifications
E3.12	Identify and suggest improvements to working practices and procedures on electrical plant and equipment
E3.13	Establish that and electrical engineering process has been completed to specification
E3.14	Test the performance and condition of electrical plant and equipment
E3.15	Monitor the performance and condition of electrical plant and equipment
E3.16	Assess the performance and condition of electrical plant and equipment
E3.17	Inspect electrical plant and equipment

NC Electrical Engineering: Level 5 Mapping

Unit title	Core/Restricted core/Option	Level	C3.1	C3.2	C3.3	C3.4	C3.5	C3.6	E3.1	E3.2	E3.3	E3.4	E3.5	E3.6
Rotating Electrical Machines		5									✓			

Unit title	Core/Restricted core/Option	Level	E3.7	E3.8	E3.9	E3.10	E3.11	E3.12	E3.13	E3.14	E3.15	E3.16	E3.17
Rotating Electrical Machines		5			✓	✓	✓	✓					

NC Electrical Engineering: Level 6 Mapping

Unit title	Core/Restricted core/Option	Level	C3.1	C3.2	C3.3	C3.4	C3.5	C3.6	E3.1	E3.2	E3.3	E3.4	E3.5	E3.6
Communications: Core Skills	Core	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mathematics: Technician 1	Core	6									✓			
Information Technology for Engineering 2	Core	6	✓		✓		✓							
Electrical Principles	Restricted core	6									✓			
Electrical Testing and Measurement	Option	6			✓	✓		✓			✓	✓		

Unit title	Core/Restricted core/Option	Level	E3.7	E3.8	E3.9	E3.10	C3.11	C3.12	E3.13	E3.14	E3.15	E3.16	E3.17
Communications: Core Skills	Core	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mathematics: Technician 1	Core	6				✓	✓			✓			
Information Technology for Engineering 2	Core	6				✓	✓						
Electrical Principles	Restricted core	6			✓	✓				✓			✓
Electrical Testing and Measurement	Option	6				✓	✓			✓			

Alignment to National Occupational Standards and Units

Table 4 indicates **OTHER Relevant ECITB and SUMMIT Skills** Units used in the mapping exercise.

Table 4

Table reference	Reference number	Awarding Body	Title
01	ESI18	Summit Skills	Ensure safe site working (installation)
02	ESI70	Summit Skills	Provide technical and functional information to relevant people (installation)
03	ESI81	Summit Skills	Maintain a healthy and safe working environment (installation)
04	ESIBS23	Summit Skills	Install wiring systems, wiring enclosures and equipment (plant)
05	ESIBS45	Summit Skills	Inspect, test and commission an electrical installation (Installation)
06	ESSC33	Summit Skills	Carryout earthing and bonding procedures for structured cabling systems
07	ESSC35	Summit Skills	Carryout final inspection procedures for structured cabling systems
08	EMRR70D	Summit Skills	Provide technical and functional information to relevant people relating to electrical machine repair and rewind
09	EMRR81D	Summit Skills	Maintain a healthy and safe working environment when repairing or rewinding electrical machines
10	MPSE9	ECITB	Diagnose and determine the causes of faults in electrical plant and equipment
11	PLEATI6	ECITB	Inspect, test and commission an electrical installation (plant)
12	PLEATI9	ECITB	Diagnose and correct electrical faults (plant)

NC Electrical Engineering: Level 5 Mapping

Unit title	Core/Restricted core/Option	Level	01	02	03	04	05	06	07	08	09	10	11	12
Rotating Electrical Machines		5	✓	✓	✓						✓	✓		✓

NC Electrical Engineering: Level 6 Mapping

Unit title	Core/Restricted core/Option	Level	01	02	03	04	05	06	07	08	09	10	11	12
Communications: Core Skills	Core	6	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Mathematics: Technician 1	Core	6					✓	✓				✓	✓	✓
Information Technology for Engineering 2	Core	6	✓	✓	✓		✓			✓				
Electrical Principles	Restricted core	6				✓						✓	✓	✓
Electrical Testing and Measurement	Option	6	✓	✓	✓		✓					✓	✓	✓

Appendix 2: Indicative sequence of delivery

National Certificate in Engineering Systems at SCQF level 6

Programme delivered with purely an Engineering focus — 18 credits to full-time students

MANDATORY CORE — 3 credits required at SCQF level 6

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Communication	1	6	F3GB 12	2
Mathematics: Technician 1	1	6	F3HX 12	1
Engineering: Applying Information Technology	1	6	F5D4 12	1

RESTRICTED CORE — 5 credits required at SCQF level 6

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Engineering Systems	1	6	F5FN 12	2
Engineering Materials	1	6	F5KD 12	1
Mechanical Engineering Principles	1	6	F6X7 12	2
Electrical Principles	1	6	F5HL 12	2
Graphical Engineering Communication	1	6	F5JG 12	1

OPTION UNITS

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Mechanical Engineering Principles	1	5	F5K1 11	1
Pneumatics and Hydraulics	1	5	F5K2 11	1
Electrical Principles	1	5	F5HK 11	1
Fundamental Electronics	1	5	F5DB 11	1
Single Phase and 3 Phase Principles	1	6	F5JB 12	2
Electronic Test Equipment and Measurement	1	6	F5DJ 12	2
Application of PLCs	1	6	F5H0 12	2
CAD for Engineers	1	6	F5H5 12	2
Plant Maintenance Practice	1	5	F5J3 11	2
Health & Safety: Engineering	1	5	F5DG 11	1

OPITO Programme delivered with a blended Engineering and Process focus — 18 credits to full-time students

MANDATORY CORE — 3 credits required at SCQF level 6

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Communication	1	6	F3GB 12	2
Mathematics: Technician 1	1	6	F3HX 12	1
Engineering: Applying Information Technology	1	6	F5D4 12	1

RESTRICTED CORE — 5 credits required at SCQF level 6

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Mechanical Engineering Principles	1	6	F6X7 12	2
Electrical Principles	1	6	F5HL 12	2
Single Phase and 3-Phase Principles	1	6	F5JV 12	2
Process Measurement and Control: An Introduction	1	6	F6X8 12	1
Process Chemistry: An Introduction	1	6	F6X9 12	1

OPTION UNITS

Unit title	Credit value	SCQF level	SQA code	Delivery Semester
Mechanical Engineering Principles	1	5	F5K1 11	1
Thermofluids	1	6	F5JE 12	1
Electrical Principles	1	5	F5HL 11	1
Rotating Electrical Machines	1	5	F5JK 11	2
Engineering: Distributed Control Systems	1	6	F5KM 12	2
Engineering: Control Valves & Positioners	1	6	F5KL 12	2
Process Operations: Oil and Gas Separation	1	5	FM3C 11	2
Process Operations: Gas Processing Operations	1	5	FM3D 11	2
Process Operations: Utilities	1	5	FM3E 11	1
Engineering: Hazards, Protection Methods and Functional Safety	1	6	F5KP 12	1