



Arrangements for:
HNC Electrical Engineering
Group Award Code: G7TA 15

HND Electrical Engineering
Group Award Code: G7TC 16

Validation date: (March 2005)

Version: 13 (May 2015)

Acknowledgement

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

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. Centres are advised to check SQA's APS Navigator to confirm they are using the up to date qualification structure.

NOTE: Where a Unit is revised by another Unit:

- ◆ No new centres may be approved to offer the Unit which has been revised.
- ◆ Centres should only enter candidates for the Unit which has been revised where they are expected to complete the Unit before its finish date.

Version number	Description	Date
13	Revision of Unit: DE1K 33 Workplace Communication in English has been revised by H8T2 33 and finishes on 31/07/2016.	08/05/15
12	Removal of finish date from unit DG4P 35 <i>Mathematics for Engineering 3</i> . Addition of Credit Transfer Table <i>see Pages 39 and 40</i> .	15/01/15
11	Revision of Units: D77G 34 <i>Communication: Practical Skills</i> revised by H7MB 34. DG4H 33 <i>Mathematics for Engineering 1: Electronics and Electrical</i> revised by H7K0 33 <i>Engineering Mathematics 1</i> . DG4L 34 <i>Mathematics for Engineering 2</i> revised by H7K1 34 <i>Engineering Mathematics 2</i> on HNC and HND frameworks finishing 31/07/2016.	21/10/14
10	<i>Engineering Mathematics 3</i> (H7K2 34), <i>Engineering Mathematics 4</i> (H7K3 35) and <i>Engineering Mathematics 5</i> (H7K4 35) added as optional Units to HND framework.	19/08/14
09	<i>Project Management: An Introduction</i> (A6AX 34) added as an optional Unit to HND framework.	15/08/14
08	Addition of optional Units: <i>Energy Overview</i> (H4J5 34) and <i>Energy Technologies</i> (H4J6 35).	09/08/13
07	Due to the HN Review the following Units have been amended and recoded: DN4F 35, DN48 33, DN4L 34, DN4J 34, DN42 34, DG2X 34 and DG54 34.	26/04/12
06	Optional section of framework on page 17 updated to include three missed Units.	18/10/11
05	Credit transfer amended on Communication Unit from full to partial.	January 2011
04	Units added to HND within optional area of the framework to give direct articulation in to year 3 of Robert Gordon's University BEng Course.	December 2009
03	Broadening and other Units added to HNC and HND.	November 2007

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1 Introduction

This Arrangements Document has been written in order to assist centres in preparing for approval of the new HNC and HND Electrical Engineering awards and maintaining the awards thereafter. These two awards were developed under the new SQA Design Principles, were validated in March 2005, and replace the existing HNC Engineering: Electrical and the HND Engineering: Electrical.

This Document includes details on the background to the development of the new awards, their aims (both general and specific), recommended access requirements, information about the structure of the awards, recommendations on delivery and assessment and other guidance for centres.

2 Rationale for the Revisions of the Awards

2.1 Electrical Engineering

The term Electrical Engineering in the context of this document covers the range of subjects traditionally included in SQA Higher Nationals in Electrical Engineering, namely power, plant and electrical installation. The title Electrical Engineering is intended to provide candidates, lecturers, Higher Education, employers and professional bodies with a clear, unambiguous title.

Electronics has not been included in the HNC and HND Electrical Engineering titles as only sufficient electronics has been included in both awards to underpin studies in the various branches of electrical engineering.

2.2 HN Engineering Frameworks

In 1996 the SQA validated nationally a large number of new HN Engineering awards including two awards entitled HNC Engineering: Electrical and HND Engineering: Electrical. A major difference between these and previous awards was that they all sat within an HN Engineering Framework which in general terms consisted, for both HNCs and HNDs, of a common core of Units (Units common to all HNC and HND Engineering awards), a principles/technology and optional sections. The benefits of this Framework structure were seen to include the following:

- ◆ provide a wide range of HN Engineering qualifications to meet the needs of different engineering sectors
- ◆ improve the credibility and esteem of individual HN Engineering awards
- ◆ clarify those competencies that were general to all incorporated engineers and those that were specific to particular engineering disciplines
- ◆ provide opportunities for the efficient delivery of HN Engineering Units by, for example, incorporating Units that were common to a number of different HN awards
- ◆ facilitate better progression between HNC, HND and Degree engineering awards

Prior to the development of any HN Engineering awards a major consultation exercise was undertaken on the overarching HN Engineering Framework to test the validity of the Framework. This consultation comprised of the following five strands:

- ◆ a questionnaire survey with stakeholders of HN Engineering awards
- ◆ a series of meetings with various interested stakeholders of HN Engineering awards
- ◆ desk based research
- ◆ discussions (followed by endorsement) of a proposed HN Engineering Framework at a HN Engineering Steering Group meeting
- ◆ a major consultation event with FE colleges on 24 May 2002 which included a questionnaire survey

The consultation revealed continuing strong support for an overarching HN Engineering Framework but with the following modifications:

- ◆ a reduction in the number of common core Units
- ◆ a strengthening of the Principles/Technology section with an even stronger emphasis on the teaching of core engineering principles and technologies

Optional sections are retained in all HNC and HND Engineering awards.

The revised HNC and HND Engineering Frameworks are shown in block diagram form in Figures 2.1 and 2.2. It should be noted that the PDAs shown in both diagrams may be developed as more HN Units come on stream; currently none of these PDAs exist.

HNC Engineering Framework

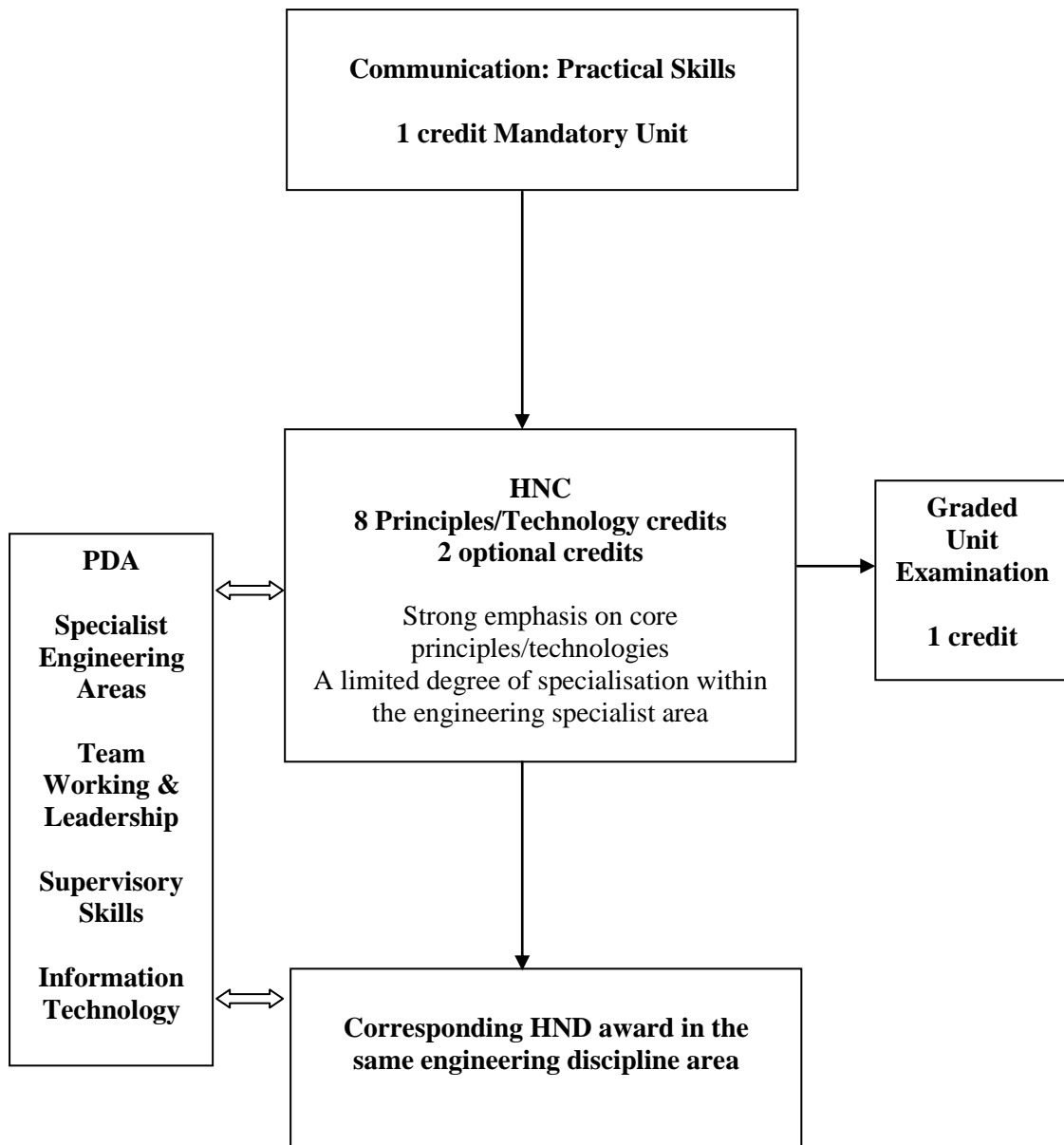


Figure 2.1

HND Engineering Framework

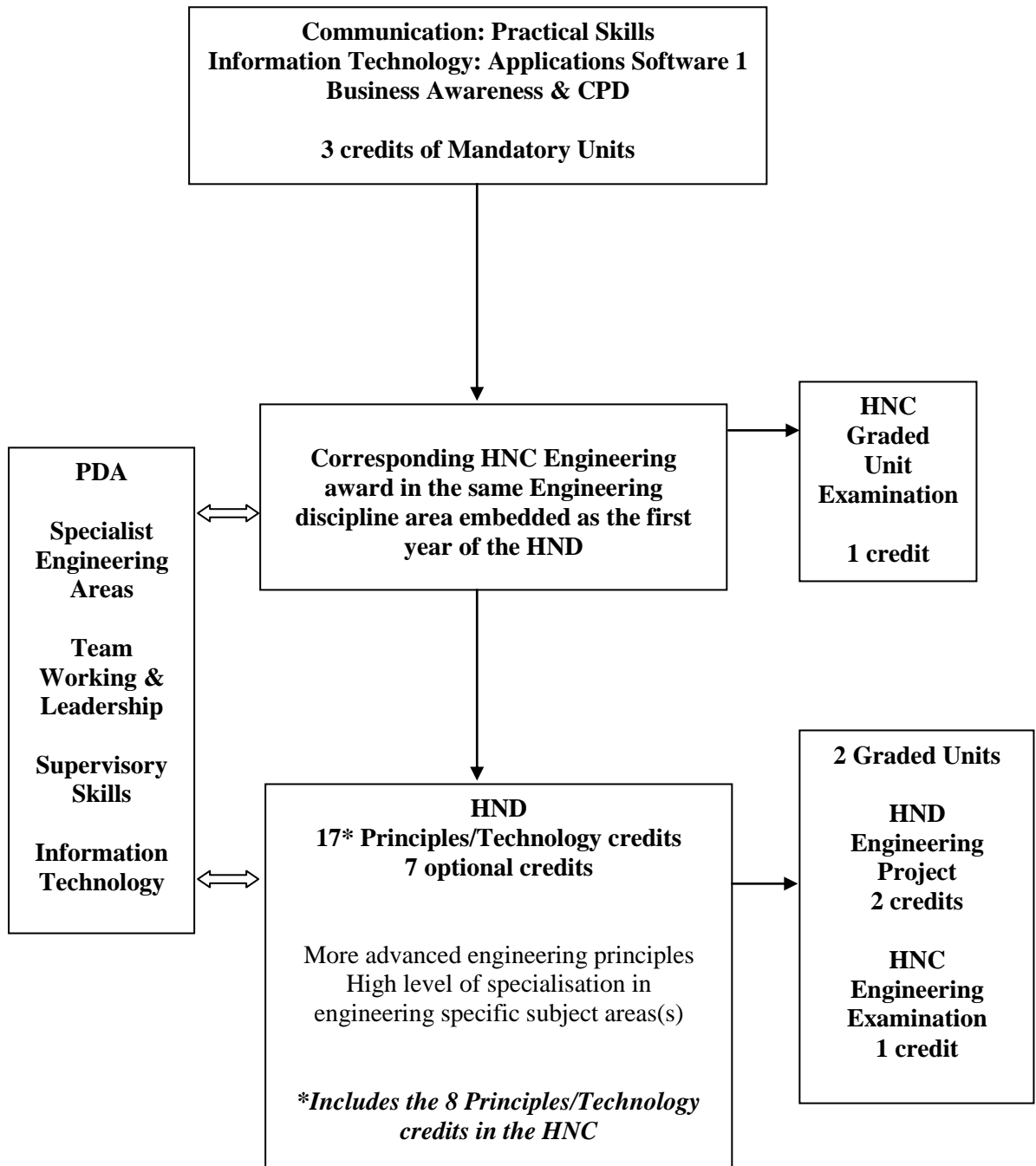


Figure 2.2

2.3 History and Market Research to support the HNC and HND Electrical Engineering

2.3.1 History of the HNC and HND Electrical Engineering awards

The introduction of the SCOTVEC Advanced Courses Development Programme led to the replacement of the 132 HND in Electrical and Electronic Engineering award by a competence based HND in Electronic and Electrical Engineering in 1989. Shortly after an HNC in Electronic and Electrical Engineering was introduced as part of a national development and replaced the 101 HNC in Electrical and Electronic Engineering. However, there continued to be little commonality between the new HNC and HND awards. The first attempt to harmonise the two awards took place as part of a consortium development in the early nineties. In 1995 and 1996 the two awards were totally harmonised (eg the HNC Electrical becoming effectively the first year of the HND) as part of a major SCOTVEC national development which saw the introduction of an overarching HN Engineering Framework. The two new awards represent a further development of Higher National Engineering awards taking full account the new HN Design Principles and providing an opportunity to update the awards in light of technological and educational developments.

2.3.2 Market Research

The development of the new HNC and HND Electrical Engineering awards included extensive market research which is summarised below in Table 2.3.

Stakeholder	Method
All	Major desk based research gathering and analysing data from various sources (eg SEMTA, FutureSkills Scotland etc.)
Delivery Centres	Initial postal survey of all delivery centres followed by two National seminars. Draft Units, assessment exemplars and outlines of graded Units were made available to centres.
Employers	Surveys of employers were carried out at the commencement of the development of the two awards and when the two award structures and Units were nearing finalisation. Information obtained from employers helped to inform both structure and Unit development
Higher Education	Letters of support for articulation between the new HNC and HND Electrical Engineering and Degree awards were received from seven Higher Education institutions.
Professional Bodies	The Chair of the Institute of Incorporated Engineers was a member of the Validation Panel and provided a broad measure of support for the two new developments at the Validation Event which was later confirmed in writing.

Table 2.3

Stakeholder	Method
Health and Safety Executive	A representative from the Health and Safety Executive provided some invaluable input into the development of the Electrical Safety Unit and other Units with significant safety content.
Students	Whilst not consulted directly the student experience of the current HNC and HND Engineering: Electrical was taken fully into account in the new developments.

Table 2.3 (continued)

2.4 Candidates

2.4.1 HNC Candidates

Candidates at HNC level may already be in employment and will attend centres on a day-release or other part-time basis. The HNC framework structure is flexible enough to allow centres to deliver the HNC award by various modes of delivery for example, two-year day-release, evening attendance etc.

The options chosen by employed candidates may reflect the branch of industry in which they are employed or may be used to gain knowledge of other areas within electrical engineering in order to improve their career opportunities in the employment market. Part-time candidates may also use the HNC award to gain entry to Degree level studies.

Full-time HNC candidates may be school leavers intending to articulate to a University Degree Course, or candidates who wish to progress from an appropriate National Certificate qualification. Full-time candidates may also be more mature persons who are seeking a change of employment.

Since the HNC award forms an integral part of the HND award, full-time candidates will complete 15 Unit credits in the first year of the course, 12 of these meeting the HNC requirements. Full-time candidates will therefore have completed the first year of the HND programme and may, if they wish, continue to the second year of the HND award.

In addition to University entrance, successful full-time HNC candidates have enhanced their prospects of gaining employment in the Electrical Engineering industry.

2.4.2 HND Candidates

The HND award programme will normally be delivered on a two-year full-time basis, although this does not preclude other delivery patterns. This being the case, HND candidates may be school leavers who have an interest in some aspect of electrical engineering and wish to include this in their career path. This may be candidates who wish to progress from an appropriate National Certificate qualification or candidates who have previously completed the HNC award and wish to progress to the HND. The typical HND candidate will therefore be a young person intending to articulate to a University Degree Course. The Units of the

HNC/D framework have been designed to introduce candidates to electrical engineering and to take topics to a more advanced level than is possible in the HNC.

Mature candidates may also embark on the HND programme. The HN Electrical Development Team and Unit writers were aware that such candidates may not have studied for some time and will require additional support in developing their learning skills. The HN Electrical Units have been designed as far as possible to provide candidates with opportunities to develop critical knowledge and understanding of theory and practical hands-on skills required by practising electrical incorporated engineers.

3 Aims of the Awards

3.1 General Aims of the HNC Electrical Engineering

The general aims of this award are to:

- 3.1.1 enhance candidates' employment prospects
- 3.1.2 support candidates' Continuing Professional Development and career development
- 3.1.3 enable progression within the SCQF (Scottish Credit and Qualifications Framework)
- 3.1.4 develop candidates' ability to apply analysis and synthesis skills to the solution of electrical engineering problems
- 3.1.5 develop learning and transferable skills (including Core Skills).

3.2 Specific Aims of the HNC Electrical Engineering

The specific aims of this award are to:

- 3.2.1 provide an award that will allow candidates to work now, or in the future, as electrical technicians or incorporated electrical engineers
- 3.2.2 provide an award that creates a route towards meeting the academic requirements for Incorporated Engineer status
- 3.2.3 develop an award that on successful completion will allow candidates to progress to HND Electrical Engineering and/or a Degree in Electrical Engineering or related subject discipline area

The development of this new HNC award will also allow candidates to:

- 3.2.4 develop a range of Communication knowledge and skills relevant to the needs of electrical incorporated engineers

- 3.2.5 develop knowledge, understanding and skills in a range of core electrical principles, electrical power systems, electrical machine principles and electrical safety at Higher National level (these studies in core electrical principles and technologies are underpinned by a mandatory Unit in Mathematics)
- 3.2.6 develop knowledge and skills in the use of electrical and electronic instruments
- 3.2.7 achieve a degree of specialisation within the following areas: Electrical Principles, Information Technology, Three Phase Induction Motors, Power Electronics, Inspection and Testing of Low Voltage Electrical Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Control Systems, further Mathematical studies, Electrical Installation Skills and Engineering Quality
- 3.2.8 on successful completion of the award, achieve the Core Skill Communication at Higher level and the component Using Number of the Core Skill Numeracy at Higher level. The candidate will also be provided with opportunities to develop the following Core Skills: Information Technology at Higher level, the component Using Graphical Information of the Core Skill Numeracy at Higher level, Problem Solving at Higher level and Working with Others at Intermediate 1 level.

3.3 General Aims of the HND Electrical Engineering

The same as for the HNC Electrical Engineering award but with the addition of the following:

- 3.3.1 develop candidates' knowledge and skills in planning and project management
- 3.3.2 develop investigation skills

3.4 Specific Aims of the HND Electrical Engineering

The same as for the HNC Electrical Engineering but with the addition of the following:

- 3.4.1 develop an award that on successful completion will allow candidates' to progress to a Degree in Electrical Engineering or related subject discipline area.

The development of this new HND award will also allow candidates to:

- 3.4.2 develop knowledge and understanding of the external and internal factors that influence the performance of modern companies
- 3.4.3 recognise the important role Continuing Professional Development plays in career development
- 3.4.4 expand on the range of knowledge, understanding and skills in core electrical principles, electrical machines and systems and electrical installation

- 3.4.5 allow for further specialisation within the following subject areas:
Inspection and Testing of Low Voltage Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Analogue and Digital Electronics, Quality Management, Electrical Installation Skills, Industrial Plant Maintenance, Synchronous Machines, Electrical Motor Drive Systems, Three Phase Induction Motors, High Level Engineering Software, additional Control Systems studies, Power Supply Circuits, Switchgear and Protection, Standby Systems, Electrical Installation Design: Computer Aided, advanced Mathematical studies and Employment Experience
- 3.4.6 on successful completion of the award, achieve the Core Skills in Communication at Higher level, Information Technology at Higher level, Problem Solving at Higher level and the Using Number component of the Core Skill Numeracy at Higher level. Candidates will be provided with opportunities to develop the Core Skill Using Graphical Information component of the Numeracy Core Skill at Higher level and the Working with Others Core Skills at Intermediate 1 level.

3.5 How the General Aims are met in the HNC and HND Award Structures and Content

Aim No	How it is met in HNC and HND
3.1.1	For many years HNC and HND Electrical Engineering qualifications have equipped candidates to seek employment in a wide range of manufacturing, service and public sector organisations. Market research indicates that HNC and HND Electrical Engineering awards are still regarded as the minimum qualifications required by many organisations to work at electrical technician or incorporated engineer level.
3.1.2	There has been a long tradition of candidates in employment taking HNC Electrical and Electronic awards on a part-time basis to increase their knowledge of Electrical and Electronic Engineering and enhance their career development. In recent years, with increased commonality between HNC and HND Electrical Engineering awards and greater flexibility in the way these awards are delivered, candidates in employment have increasingly taken HNDs on a part-time basis to expand their knowledge and skills in Electrical and Electronic Engineering and improve their career prospects. The two new awards contain a balance of core principles and up to date knowledge and skills in Electrical Engineering which lends themselves to the Continuous Professional Development and career development of candidates working at electrical technician and incorporated engineer levels. Furthermore, the award structures have been designed to allow for easy progression between HNC and HND awards.
3.1.3	All Units within the new HNC and HND Electrical Engineering awards have been levelled at SCQF levels 6, 7 or 8. The two new awards also conform to the SQA levelling requirements for HNC and HND awards. Thus, successful completion of one or both awards will allow progression within the SCQF.
3.1.4	The nature of Electrical Engineering as a discipline lends itself to both the analysis and synthesis of problems. For example, when a complex electrical and electronic system is analysed (using, say, a block diagram approach) by breaking it down into separate functional parts or alternatively the synthesis of a complex system from simpler electrical and electronic systems. The two new awards allow these important skills to be developed further both in the technical subjects and in the core Communication, Information Technology and Business Awareness and Continuing Professional Development Units.

Aim No	How it is met in HNC and HND
3.1.5	<p>The new HNC and HND Electrical Engineering awards provide centres with an opportunity to enhance learning skills not least by creating opportunities for candidates to combine theory and practice to achieve a real understanding of a subject. For example, some 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 sophisticated electrical and electronic laboratory equipment and/or on-line delivery and/or Virtual Learning Environments to enhance candidate learning.</p> <p>By their very nature Engineering courses require the transfer of technical knowledge and skills from one area to another. For example, a significant level of Electrical Principles and Mathematics has been included in both HNC and HND Electrical Engineering awards because these subjects provide underpinning knowledge, understanding and skills which are used elsewhere in both awards. Candidates will also have an opportunity to use the Communication and Information Technology knowledge and skills developed in the mandatory core Units in other parts of the awards to support such activities as report writing, presentation and the application of specialist software packages. Core skills in general, and problem solving in particular, have been regarded as very important by the HN Electrical Development Team since it is recognised that a good level of competence in these is essential in the work of an incorporated electrical technician.</p>
3.3.1	<p>The double credit (16 SCQF points) Engineering Project Graded Unit in the HND Electrical Engineering award provides opportunities for candidates to develop both their planning and project management knowledge and skills.</p>
3.3.2	<p>The Business Awareness and Continuing Professional Development Unit provides candidates with the opportunities to develop their investigative skills by exploring the external and internal factors that affect the performance of a modern company and the different ways that people learn. The Engineering Project also requires candidates to undertake some investigations into the background to and a range of solutions for their engineering project.</p>

3.6 How the Specific Aims are met in the HNC and HND Award Structures and Content

Aim No	How it is met in HNC and HND
3.2.1	An HNC and HND Electrical Engineering award has been recognised for many years by employers and other stakeholders of these awards as appropriate qualifications for persons wishing to work at electrical technician or senior technician levels. Market research indicates that there is a growing demand for people with technician level skills in electrical and electronic engineering especially as companies automate a lot more of their processes. Thus, it is confidently anticipated that those achieving the HNC and HND Electrical Engineering awards will find employment as electrical technicians and incorporated electrical engineers in a wide range of small, medium and large companies.
3.2.2 &	An HNC or HND no longer satisfies fully the academic requirements for Incorporated Engineer status although these qualifications continue to completely satisfy Engineering Technician requirements. The minimum qualification for Incorporated Engineer is an ordinary Degree.
3.2.3	Given the clear progression routes that have been established between existing HNC and HND Electrical Engineering awards and Degree courses by many FE colleges and universities, it is strongly anticipated that similar progression routes will also be developed between the new HNC and HND Electrical Engineering awards and Degree courses. Thus, HNC and HND Electrical Engineering awards will continue to form very important 'stepping stones' towards candidates achieving Degrees (and, thus, satisfy fully the academic requirements for Incorporated Engineer status). Progression arrangements between HNCs, HNDs and Degrees can only be strengthened with the full implementation of the SCQF. Seven letters have been received from Scottish Universities confirming articulation arrangements between the new HNC and HND Electrical Engineering awards and Degree programmes.

Aim No	How it is met in HNC and HND
3.2.4	<p>The current HNC and HND Engineering awards contain separate Communication and Information Technology Applications Units within their mandatory cores. The market research information gathered through various consultations indicates that there continues to be solid support for the inclusion of a distinct Communication Unit in the mandatory core of the HNC and a Communication and Information Technology Units within the mandatory core of the HND Engineering award. The benefit of having separate Communication and Information Technology Units is that it significantly improves the prospect of sufficient attention being given to the teaching of these two key subjects. Separate Units also make it possible to ensure that the Communication and Information Technology core skills at Higher level are fully embedded within the respective Units within the HND. Award designers considered this a more appropriate way to ensure that these core skills are included in HN Engineering awards than trying to embed such core skills across, say, a range of engineering Units, except at HNC level where they believe there is considerable opportunities to develop Information Technology Core Skills within Electrical Units. A number of respondents to various surveys have expressed their concerns about Communication and Information Technology not being seen as relevant by candidates because they are not delivered and assessed within an engineering context. The HNC/D Electrical Development Team has addressed this concern by supporting the production of Communication and Information Technology assessment exemplar materials specifically contextualised to engineering.</p>
3.2.5	<p>Market research shows that employers place a high priority on employees having the correct technical and practical skills to function effectively in their job. Whilst there continues to be a debate about the precise nature of such technical and practical skills it is clearly important that electrical technicians and incorporated engineers have a sound knowledge and understanding of core electrical principles. Such knowledge and understanding will serve candidates well in employment and provide the platform for learning more advanced technical skills. The Mandatory section of the new HNC Electrical Engineering award reflects this concentration on core principles by providing studies in the key areas of Electrical Engineering namely: electrical principles, electrical power systems, electrical machine principles and electrical safety. The HN Electrical Development Team also took the view that a knowledge and understanding of Mathematics is fundamental to the work of electrical technicians and has included a Mathematics Unit (containing the Using Number component of the Core Skill Numeracy at Higher level) within the Mandatory section of the HNC Electrical Engineering award. The inclusion of Mathematics within the Mandatory section was widely supported during various consultation processes.</p>
3.2.6	<p>The correct use of electrical and electronic instruments is very important to electrical technicians and incorporated engineers. The Electrical Development Team regard such skills as so important that it has included a Unit on the use of electrical and electronic instruments in the Mandatory section of the HNC.</p>

Aim No	How it is met in HNC and HND
3.2.7	<p>In the 2-credit optional section candidates will be able to specialise further in the following areas: Electrical Principles, Information Technology, Three Phase Induction Motors, Power Electronics, Inspection and Testing of Low Voltage Electrical Installations, Programmable Logic Controllers, Electrical Systems in Hazardous Environments, Control Systems, further Mathematical studies, Electrical Installation Skills and Quality Management. The HN Electrical Development Team strongly recommends that candidates with little or no practical electrical experience take the Electrical Installation Skills Unit as part of their optional studies. Analysis of candidate uptake of Units in the optional section of the current HNC Engineering: Electrical award revealed that many Units had low entry numbers. The HN Electrical Development Team took the view that given the resources available for Unit development purposes, efforts should be concentrated on the development of optional Units where there was a reasonable confidence of high candidate uptake. This explains why there are only a limited number of Units in the optional section. Consultation with the FE sector and other stakeholders has indicated that the choice of Units in the optional section is correct. One advantage of limiting the number of optional Units is that more attention has been given to these Units resulting, in the view of the Development Team, in better quality Unit specifications.</p> <p>The HN Electrical Development Team does not preclude additional Units being added to the optional section especially where demand for such Units can be demonstrated.</p>
3.2.8	<p>The Communication Core Skill at Higher level has been incorporated into the HNC Electrical Engineering award through the mandatory Unit, Communication: Practical Skills. There was strong support for the inclusion of the Numeracy core skill at Higher within both HNC and HND Engineering awards. The Electrical Development Team has adopted the Unit Mathematics for Engineering 1: Electronics and Electrical (taken from the HNC and HND Electronics awards). The Core Skill component Using Number at Higher is embedded in this Unit. Opportunities to develop the Core Skills Information Technology, Problem Solving and Working with Others are signposted within individual Unit specifications. Candidates may achieve the Information Technology and Working with Others Core Skills at Higher level if they take the optional Units in Information Technology: Applications Software 1 in the HNC and Employment Experience 2 within the HND, respectively.</p>
3.4.1	See comments under 3.2.2 and 3.2.3.

Aim No	How it is met in HNC and HND
3.4.2 & 3.4.3	It has been traditional to deliver some form of Business Studies Unit in HND Engineering awards looking at issues such as costing/pricing of products and services. However, the focus of the new Business Awareness and Continuing Professional Development Unit is quite different looking as it does at the changing industrial environment in which incorporated engineers have to work nowadays. This environment is characterised by globalisation of the market place leading to world-wide marketing opportunities and competitive pressures; greater use of advanced technologies and the predominance of Small and Medium Sized Enterprises in the British economy. It is important that HND Engineering candidates are suitably prepared to work in this ever-changing employment environment. The Business Awareness and Continuing Professional Development Unit seeks to do this by allowing candidates to explore the external factors that affect the performance of modern companies and the ways in which companies are responding to these external pressures internally. The Unit also has an Outcome on the important role that continuous learning and Continuing Professional Development will increasingly play in helping candidates to obtain sustainable and rewarding employment. Consultation with the FE sector and other interested stakeholders of HND Engineering awards has shown a strong measure of support for the Business Awareness and Continuing Professional Development Unit.
3.4.4	The Mandatory section of the HND Electrical Engineering award contains all the Units in the Mandatory section of the HNC Electrical Engineering award. In addition, within the Mandatory section of the HND Electrical Engineering awards there are Units which allow candidates to expand their knowledge, understanding and skills in the key areas of electrical principles, electrical machines and systems and electrical installation. The Electrical Development Team has also considered it important to build on the mathematical skills developed in the Mathematics for Engineering 1: Electronics and Electrical Unit by including another core Mathematics Unit (entitled Mathematics for Engineering 2) within the Mandatory section of the HND award. The main subject area of this Unit is Calculus.
3.4.6	<p>The Communication and Information Technology Core Skills at Higher level have been incorporated into the HND Electrical Engineering award through the mandatory core Units Communication: Practical Skills and Information Technology: Application Software respectively.</p> <p>The component Using Number of the Core Skill Numeracy at Higher is embedded within the Unit Mathematics for Engineering 1: Electronics and Electrical. The Core Skill Problem Solving at Higher level is embedded within the 2 credit HND Graded Unit. Candidates may achieve the Core Skill Working With Others at Higher level if they take the optional Unit Employment Experience 2. Opportunities to develop the Core Skill component Using Graphical Information at Higher level are signposted within individual Unit specifications.</p>

4 Recommended access

4.1 Access requirements

Admission to the HNC and HND Electrical Engineering award courses 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 awards successfully. To this end, 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 to selection of candidates. It is recommended that candidates should possess the following:

- ◆ One Higher from Physics, Technological Studies or Higher Mathematics and at least three Standard Grades 1-2/ Intermediate 2 passes including Mathematics, Physics/Technological Studies and English.
- ◆ National Certificate Group Award in Electrical Engineering or Electronic Engineering
- ◆ Qualification comparable to the above, gained through other awarding bodies such as GSCE, City & Guilds, Edexcel etc.
- ◆ At the discretion of the Principal of the presenting centre for applicants with a different experiential background who could benefit from taking the award(s) or Units within the award(s), eg adult returners, overseas students with relevant work and/or work experience.

4.2 Alternative Access Arrangements

The presenting centre may operate alternative access arrangements in cases where the candidate is convinced that she/he 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 to outline their systems for each of these as a part of any approval procedure.

5 Structure of the qualifications

5.1 HNC Electrical Engineering Structure: G7TA 15 12 Unit credits

Mandatory Units (9.0 credits required)

Unit No	Unit title	Credit value	SCQF level
H7MB 34*	Communication: Practical Skills	1	7
H7K0 33*	Engineering Mathematics 1	1	6
DN47 34	Three Phase Systems	1	7
DN3W 34	Electricity Power Systems	1	7
DN4J 34 (finishes 31/07/2013)	Electrical Machine Principles OR	2	7
H01T 34	Electrical Machine Principles	2	7
DN4L 34 (finishes 31/07/2013)	Electrical Safety OR	1	7
H01V 34	Electrical Safety	1	7
DG54 34 (finishes 31/07/2013)	Single Phase A.C. Circuits OR	1	7
FY9E 34	DC and AC Principles	1	7
DN48 33 (finishes 31/07/2013)	Application of Electrical and Electronic Instruments OR	1	6
H03B 33	Application of Electrical and Electronic Instruments	1	6

Optional Units (2.0 credits required)

Unit No	Unit title	Credit value	SCQF level
DG3G 34	Electrical Networks and Resonance	1	7
D75X 34	Information Technology: Applications Software 1	1	7
DN42 34 (finishes 31/07/2013)	Power Electronics OR	1	7
FY9R 34	Power Electronics	1	7
DN41 34	Inspection and Testing of Low Voltage Electrical Installations	1	7
DG31 34	Applications of Programmable Logic Controllers	1	7
DN3T 34	Electrical Systems in Potentially Explosive and Gas Hazardous Environments	1	7
DN3Y 34	Fundamentals of Control Systems and Transducers	1	7
H7K1 34*	Engineering Mathematics 2	1	7
DN4H 34	Electrical Installation Skills	1	7
DN45 35	Three Phase Induction Motors	1	8
DT8Y 34	Quality Management: An Introduction	1	7
DE3R 34	Personal Development Planning	1	7
H8T2 33*	Workplace Communication in English	1	6
D96A 34	Promoting Energy Efficiency in the Workplace	1	7
DV9J 34	Electrical Design Systems: An Introduction	1	7
DV9K 34	Electrical Installation Design (Computer Aided): An Introduction	1	7
H4J5 34*	Energy Overview	1	7

*Refer to History of Changes for revision changes.

Graded Unit (1.0 credit)

Unit No	Unit title	Credit value	SCQF level
DN3V 34	Electrical Engineering: Graded Unit 1 (Examination)	1	7

5.2 HND Electrical Engineering Structure: G7TC 16 30 Unit credits

Mandatory Units (20.0 credits required)

Unit No	Unit title	Credit value	SCQF level
H7MB 34*	Communication: Practical Skills	1	7
D75X 34	Information Technology: Applications Software 1	1	7
DG3D 35	Business Awareness and Continuing Professional Development	1	8
H7K0 33*	Engineering Mathematics 1	1	6
DG54 34	Single Phase AC Circuits	1	7
<i>(finishes 31/07/2013)</i>	OR		
FY9E 34	DC and AC Principles	1	7
DN47 34	Three Phase Systems	1	7
DN3W 34	Electricity Power Systems	1	7
DN4J 34	Electrical Machine Principles	2	7
<i>(finishes 31/07/2013)</i>	OR		
H01T 34	Electrical Machine Principles	2	7
DN4L 34	Electrical Safety	1	7
<i>(finishes 31/07/2013)</i>	OR		
H01V 34	Electrical Safety	1	7
DN48 33	Application of Electrical and Electronic Instruments	1	6
<i>(finishes 31/07/2013)</i>	OR		
H03B 33	Application of Electrical and Electronic Instruments	1	6
DG3G 34	Electrical Networks and Resonance	1	7
DN42 34	Power Electronics	1	7
<i>(finishes 31/07/2013)</i>	OR		
FY9R 34	Power Electronics	1	7
DN3Y 34	Fundamentals of Control Systems and Transducers	1	7
H7K1 34*	Engineering Mathematics 2	1	7
DG57 35	Transmission Lines and Complex Waves	1	8
DN4F 35	Electrical Installation Design	1	8
<i>(finishes 31/07/2013)</i>	OR		
FY7L 35	Electrical Installation Design	1	8
DN4K 35	Electrical Motor Drive Systems	1	8
DN49 35	Transformers	1	8
DN4A 35	Utilisation of Electrical Energy in Buildings	1	8

*Refer to History of Changes for revision changes.

Optional Units (7.0 credits required)

Unit No	Unit title	Credit value	SCQF level
DN41 34	Inspection and Testing of Low Voltage Electrical Installations	1	7
DG31 34	Applications of Programmable Logic Controllers	1	7
DN3T 34	Electrical Systems in Potentially Explosive and Gas Hazardous Environments	1	7
DN46 33	Analogue Electronics: An Introduction	1	6
DN4E 34	Digital Electronics	1	7
DT8Y 34	Quality Management: An Introduction	1	7
DN4H 34	Electrical Installation Skills	1	7
DN40 34	Industrial Plant Maintenance	1	7
DG58 34	High Level Engineering Software	1	7
DN4D 35	Control Systems Behaviour	1	8
DG4P 35	Mathematics for Engineering 3	2	8
DG50 35	Power Supply Circuits	1	8
DN43 35	Switchgear and Protection of High Voltage Systems	1	8
DN4C 35	Applications of Power Electronics in Electrical Motor Drive Systems	1	8
DN45 35	Three Phase Induction Motors	1	8
DN44 35	Synchronous Machines	1	8
DN4M 35	Electrical Standby Systems	1	8
DN4G 35	Electrical Installation Design: Computer Aided	1	8
DE3R 34	Personal Development Planning	1	8
H8T2 33*	Workplace Communication in English	1	6
D96A 34	Promoting Energy Efficiency in the Workplace	1	7
DV9J 34	Electrical Design Systems – An Introduction	1	7
DV9K 34	Electrical Installation Design (Computer Aided): An Introduction	1	7
A6AX 34*	Project Management: An Introduction	1	7
H7K2 34*	Engineering Mathematics 3	1	7
H7K3 35*	Engineering Mathematics 4	1	8
H7K4 35*	Engineering Mathematics 5	1	8
DG6E 34	Work Role Effectiveness	3	7
	OR		
DG6G 35	Work Role Effectiveness	3	8
DG2X 34	Analogue Electronic Principles	2	7
	OR		
	<i>(finishes 31/07/2013)</i>		
FY9T 34	Analogue Electronic Principles	2	7
DG3C 34	Combinational Logic	1	7
DG53 34	Sequential Logic	1	7
DG59 34	MCU/MPU Assembly Language Programming	1	7
H4J5 34*	Energy Overview	1	7
H4J6 35*	Energy Technologies	1	8

*Refer to History of Changes for revision changes.

Graded Unit (3.0 credits required)

Unit No	Unit title	Credit value	SCQF level
DN3V 34	Electrical Engineering: Graded Unit 1 (Examination)	1	7
DN3X 35	Electrical Engineering: Graded Unit 2 (Project)	2	8

5.3 Graded Units

The purpose of the Graded Unit for both the HNC and HND awards is to assess the candidate's ability to apply and integrate knowledge and/or skills gained within individual Units. By this means candidates will demonstrate that they have achieved the specific aims of the awards as detailed in Sections 3.2 and 3.4. The Graded Units also provide the means by which a candidate's achievement can be graded.

HNC Electrical Engineering candidates will undertake a **one** Credit Graded Unit at level 7. This will be in the form of a 3-hour written examination.

HND Electrical Engineering candidates will also do the HNC Graded Unit but, in addition, will undertake a **two** Credit Graded Unit at level 8. This will take the form of a practical assignment/project.

5.3.1 Types of Graded Units

HNC Electrical Engineering: Graded Unit 1 — Examination

It will be noted that the Graded Unit draws on Outcomes in the mandatory section of the award which are studied by all HNC Electrical Engineering candidates.

The assessment for the Electrical Engineering: Graded Unit 1 consists of an examination paper which should last three hours.

It is recommended that candidates do not sit the Graded Unit Examination until the end of the HNC (1st Year of the HND), given the range of Units that it draws from.

HND Electrical Engineering: Graded Unit 2 — Project

The nature of the project activity is such that it is likely that centres will wish their candidates to embark on it from the start of the second year of the HND Electrical Engineering programme. As it is anticipated that centres will deliver the HNC Electrical Engineering as part of the first year of the HND, it is recommended that candidates have completed all HNC Electrical Engineering Units, including the HNC Graded Unit, before commencing the project.

In principle, the project can draw on any Units in the HND Electrical Engineering framework although the majority of Units should be at SCQF level 8. The project can be taken from one Electrical Engineering area (eg Electrical Machines) or it can span more than one technical area. However, its principal purpose is not to integrate technical content (this is covered in Electrical Engineering: Graded Unit 1) but rather to combine such knowledge and skills as planning, construction, testing, evaluating and reporting.

5.3.2 Rationale for the Graded Units Assessment

The assessment methods ie an examination for Graded Unit 1 and a project for Graded Unit 2 were decided through consultation with industry and delivering centres during initial consultation on the overarching HN Engineering framework (see HNC and HND Electronics Validation Document for more details).

The consultation indicated that an ‘examination’ provided a more accurate way of assessing candidates’ abilities to apply and integrate knowledge and understanding from various technical and related areas, such as Communication. Furthermore, it was considered that during their HNC studies candidates will not normally develop fully the necessary knowledge and skills to complete a project.

A project was preferred at the HND level because a project-based assignment provides candidates with opportunities to demonstrate not only their knowledge and skills in a technical area(s) but also in areas such as planning, construction, testing, evaluating and reporting which are important aims within the HND Electrical Engineering award

5.4 Core Skills

The HNC and HND Electrical Engineering awards have been designed using the new HN Design Principles and therefore the importance of core skills has been recognised and been incorporated, where appropriate, throughout the awards.

HNC Electrical Engineering

Core Skills Exit Profile

A candidate who successfully achieves an HNC Electrical Engineering will automatically obtain the following Core Skills exit profile:

- ◆ Communication Higher (fully embedded in the Unit Communication: Practical Skills)
- ◆ Numeracy Using Number component of Numeracy Core Skill at Higher (embedded in the Unit Mathematics for Engineering 1: Electronics and Electrical)

Core Skills Entry Profile

Given the information on Core Skills provided in the previous section the following candidate Core Skills entry profile is recommended:

- ◆ Communication Intermediate 2
- ◆ Information Technology Intermediate 2
- ◆ Numeracy Intermediate 2
- ◆ Problem Solving Intermediate 2
- ◆ Working with Others Intermediate 1

HND Electrical Engineering

Core Skills Exit Profile

A candidate who successfully achieves an HND Electrical Engineering will automatically obtain the following Core Skills exit profile:

- ◆ Communication Higher (fully embedded in the Unit Communication: Practical Skills)
- ◆ Information Technology Higher (fully embedded in the Unit Information Technology: Applications Software 1)
- ◆ Numeracy Using Number component of Numeracy Core Skill at Higher (embedded in the Unit Mathematics for Engineering 1: Electronics and Electrical)
- ◆ Problem Solving Higher (fully embedded in the Unit Electrical Engineering: Graded Unit 2)

Core Skills Entry Profile

The recommended Core Skills entry profile is as follows (it should be noted that it is the same as for the HNC Electrical Engineering):

- ◆ Communication Intermediate 2
- ◆ Information Technology Intermediate 2
- ◆ Numeracy Intermediate 2
- ◆ Problem Solving Intermediate 2
- ◆ Working with Others Intermediate 1

Unit writers have also identified in individual Units opportunities to develop core skills. These development opportunities are summarised in Figure 5.4.1.

Figure 5.4.1 HN Electrical Units — Core Skills Development Opportunities

Note 1: Units that were originally developed as part of the new HNC/D Electronics awards are not shown in this table. Refer to the new HNC/D Electronics Arrangements Document and the individual Unit specifications for the core skills development opportunities.

Note 2: *CT = Critical Thinking; P & O = Planning & Organisation and R and E = Reviewing & Evaluating*

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Three Phase Systems (DN47 34)				Higher	Higher		Higher			
Electricity Power Systems (DN3W 34)	Higher	Higher		Higher	Higher	Higher	Higher			
Electrical Machine Principles (DN4J 34) <i>(finishes 31/07/2013)</i> OR Electrical Machine Principles (H01T 34)				Higher	Higher		Higher			Intermediate 1 Working co-operatively with others in a group when analysing constructional features of machines and when undertaking laboratory work

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Electrical Safety (DN4L 34) <i>(finishes 31/07/2013)</i> OR Electrical Safety (H01V 34)	Higher Reading complex Health & Safety documentation	Int 1 Completing work permit					Higher			Intermediate 2 Work with others in a role play scenario: eg issuing a Permit to Work, identifying risk factors
Application of Electrical and Electronic Instruments (DN48 33) <i>(finishes 31/07/2013)</i> OR Application of Electrical and Electronic Instruments (H03B 33)	Higher				Int 2	Int 2 Searching for manufacturers' data on instruments on the Internet	Int 2		Int 2	

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Power Electronics (DN42 34) <i>(finishes 31/07/2013)</i> OR Power Electronics (FY9R 34)	Higher	Higher		Higher	Higher	Int 2 Simulation of circuits plus search of manufacturers' data on power electronic devices	Higher		Int 2	
Fundamentals of Control Systems and Transducers (DN3Y 34)	Higher	Higher			Higher		Higher			Int 1 Opportunities to work in groups for laboratory investigations
Electrical Installation Design (DN4F 35) <i>(finishes 31/07/2013)</i> OR Electrical Installation Design (FY7L 35)	Higher	Higher		Higher	Int 2		Higher	Higher		Int 2 Scope for Working with Others within Installation Learning Design Exercises (eg planning and organising role)
Electrical Motor Drive Systems (DN4K 35)	Higher	Higher			Higher		Higher		Higher	

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Transformers (DN49 35)	Higher			Higher	Higher		Higher			
Utilisation of Electrical Energy in Buildings (DN4A 35)	Higher	Higher		Higher	Higher		Higher	Higher	Higher	
Inspection and Testing of Low Voltage Electrical Installations (DN41 34)	Higher	Int 2					Higher	Int 2	Int 2	
Electrical Systems in Potentially Explosive and Gas Hazardous Environments (DN3T 34)	Higher					Int 2 Searching on the Internet for manufacturers' data on apparatus to provide explosion protection or intrinsically safe equipment	Higher			

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Analogue Electronics: An Introduction (DN46 33)	Int 2			Int 2	Int 2	Int 2 Simulation of circuits plus search of manufacturers' data on electronic devices	Int 2			Int 1 Opportunities to work in groups for laboratory investigations
Digital Electronics (DN4E 34)	Int 2			Int 1	Int 2	Int 2 Simulation of circuits plus search of manufacturers' data on electronic devices	Int 2			Int 1 Opportunities to work in groups for laboratory investigations
Quality Management: An Introduction (DT8Y 34)		Int 2			Int 2		Higher			
Control Systems Behaviour (DN4D 35)	Higher	Higher		Higher	Higher	Higher	Higher		Higher	
Switchgear and Protection of High Voltage Systems (DN43 35)	Higher	Higher		Higher	Higher		Higher			

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Applications of Power Electronics in Electrical Motor Drive Systems (DN4C 35)	Higher	Higher		Higher	Higher	Int 2 Opportunities to search on the Internet for manufacturers' information	Higher	Higher	Higher	
Three Phase Induction Motors (DN45 35)	Higher	Higher		Higher	Higher		Higher	Higher	Higher	
Synchronous Machines (DN44 35)	Higher			Higher	Higher	Int 2 Use of software packages to simulate synchronous machine operation	Higher		Higher	
Industrial Plant Maintenance (DN40 34)	Higher	Higher			Int 2	Int 2 Use of CMSS software	Higher	Higher	Higher	Int 1 Opportunities to work in groups to develop maintenance strategies for different scenarios

Unit title	Communication			Numeracy		Information Technology	Problem Solving			Working with Others
	Read	Write	Oral	Using Number	Using Graphical Inform.	Using Information Technology	CT	P&O	R&E	Working with Others
Electrical Standby Systems (DN4M 35)	Higher	Higher		Int 2	Higher	Int 2 Opportunities to search on the Internet for manufacturers' information	Higher		Higher	
Electrical Installation Skills (DN4H 34)					Int 1			Int 2		
Electrical Installation Design: Computer Aided (DN4G 35)	Higher	Higher			Higher	Higher	Higher	Higher		Int 1 Working in small groups for learning how to use the software

5.5 Conditions of the Award

The conditions of award for HNC and HND Electrical Engineering qualifications are as follows:

5.5.1 HNC Electrical Engineering

A candidate will be awarded HNC Electrical Engineering on successful completion of 11 Unit credits plus 1 Graded Unit based on the HNC Electrical Engineering award structure shown in Section 5.1. More specifically this award structure requires that a candidate achieves the following:

- ◆ the 1 Unit credit Communication: Practical Skills within the mandatory section
- ◆ the remaining eight Unit credits from the mandatory section
- ◆ two Unit credits from the optional section
- ◆ Electrical Engineering: Graded Unit 1 Examination

5.5.2 HND Electrical Engineering

A candidate will be awarded HND Electrical Engineering on successful completion of 27 Unit credits plus 3 Graded Unit Assessment credits based on the HND Electrical Engineering award structure shown in Section 5.2. More specifically this award structure requires that candidates achieve the following:

- ◆ the 3 Unit credits Communication: Practical Skills, Information Technology: Applications Software 1 and Business Awareness and Continuing Professional Development within the mandatory section
- ◆ remaining seventeen Unit credits from the mandatory section
- ◆ seven Unit credits from the optional section
- ◆ Electrical Engineering: Graded Unit 1 and Electrical Engineering: Graded Unit 2

5.6 SCQF levels

Figures 5.6.1 and 5.6.2 show the distribution of SCQF levels in the HNC and HND Electrical Engineering awards respectively in the mandatory sections. It can be seen from Figure 5.6.1 that all Units in the HNC Electrical Engineering mandatory section are at level 7 except for two, the Mathematics for Engineering 1: Electronic and Electrical Unit and the Application of Electrical and Electronic Instruments Unit, which are both at level 6. The Table shows that the number of SCQF level 7 Units substantially exceeds the minimum of 48 SCQF credit points required to be in an HNC to satisfy the new HN Design Principles.

From the outset of developments, the HN Electrical Development Team recognised that the level of Mathematics achieved by the average candidate entering the current HNC Engineering: Electrical award was around Intermediate 2 (Standard Grade Credit level) and there was a need to include a SCQF level 6 Mathematics Unit in the HNC (and the first year of the HND Electrical Engineering) which consolidated candidates' existing knowledge and understanding of Mathematics particularly in the areas of transposing and solving equations and trigonometry, skills that are so important in the field of Electrical Engineering.

The Application of Electrical and Electronic Instruments Unit was originally levelled at SCQF level 7, but was relevelled at SCQF level 6 as a result of the validation process.

As noted above, the HN Electrical Development Team has levelled the remaining Units in the mandatory section of the HNC Electrical Engineering at SCQF level 7. The HN Electrical Development Team used as their benchmarks for levelling, the Highers in Electrical and Electronic Engineering and various NQ Electronic and Electrical Engineering Units and their knowledge of the content of existing Degree courses in Electronic and Electrical Engineering.

It can be seen from Figure 5.6.2 that the minimum number of SCQF level 8 Units a candidate has to take in the HND Electrical Engineering is 64 SCQF credit points which meets the minimum requirement of 64 SCQF credit points as stated in the HN Design Principles. However, it is anticipated that most candidates will undertake some optional Units at level 8 which will mean that they will comfortably exceed this minimum requirement. The case for the two level 6 Units in the HND Electrical Engineering has already been presented above. A number of the SCQF Level 8 Units in the HND follow on from corresponding level 7 Units and are, therefore, appropriately levelled at SCQF level 8. The HN Electrical Development Team also used their knowledge of existing second year Degree courses to level Units in the HND Electrical Engineering award.

Figure 5.6.1

Distribution of SCQF levels in the HNC Electrical Engineering

Level 6	Level 7	Level 8	Totals	SQA Minimum Requirements for level 7 Units
16 SCQF c.p.	64 SCQF c.p.	0 SCQF c.p.	80	48 SCQF c.p.

c.p. = credit points

Figure 5.6.2

Distribution of SCQF levels in the HND Electrical Engineering

Level 6	Level 7	Level 8	Totals	SQA Minimum Requirements for level 7 Units
16 SCQF c.p.	104 SCQF c.p.	64 SCQF c.p.	184	64 SCQF c.p.

c.p. = credit points

6 Approaches to delivery and assessment

6.1 Content and context

Throughout the design and development of the HNC and HND Electrical Engineering awards the HN Electrical Development Team has placed a high priority on producing awards that allow candidates to develop appropriate technical and practical skills. As indicated earlier, it is not possible to quantify such technical and practice skills in exact detail. However, the Development Team has taken the view that the best way to prepare candidates to meet the changing technical and practical requirements of the modern Electrical industry is to ensure candidates have a solid foundation of theory and practice upon which they can build new knowledge, understanding and skills. Thus, the mandatory section of the HNC Electrical Engineering contains fundamental studies in Electrical Principles, Electrical Machines, Power Systems, Electrical Safety and Application of Instruments. The HND Electrical mandatory section builds on and extends these studies. The studies in Electrical Engineering are underpinned by the inclusion of a core Mathematics Unit in the HNC and two core Mathematics Units in the HND. The HN Electrical Development Team believes that a good grasp of mathematics is essential to the understanding of Electrical Engineering.

The optional sections of both the HNC and HND Electrical Engineering provide candidates with the opportunity to specialise in technical and/or non-technical subjects. In line with normal good practice centres are encouraged to advise candidates to choose those options that best meet their future career and educational aspirations.

The HN Electrical Development Team has also ensured that the two new awards contain opportunities for candidates to develop a range of related skills which would make the holder of the awards better prepared for employment and/or Degree studies. For example, the Communication: Practical Skills Unit has been included within the mandatory sections of both HNC and HND awards to provide candidates with the opportunity to develop their written and group discussion skills about complex vocational issues.

Whilst a discrete Information Technology Unit is no longer included within the HNC mandatory section centres will still have the opportunity to access such a Unit via the optional section of the HNC (Information Technology: Applications Software 1). Even where centres choose not to select this Unit from the optional section there are a number of opportunities to develop Information Technology knowledge and skills within individual Units. The Information Technology: Applications Software 1 Unit has been included within the core of the HND to allow centres to concentrate on business applications, such as word processing, spreadsheets, databases, or engineering specific applications or a combination of the two.

A new type of Business Studies Unit, entitled Business Awareness and Continuing Professional Development, has been included within the mandatory section of the HND Electrical Engineering. This Unit focuses on two areas which the HN Electrical Development Team considered important to working in the modern electrical industry: namely the external and internal factors that affect business performance and the need for continuing learning and development if candidates are to have sustainable and rewarding employment in the future.

6.2 Delivery

The new HNC and HND Electrical Engineering awards can be delivered on a full-time, block-release, part-time day or part-time evening basis.

In timetabling the two new awards, centre staff should take account of information contained in the recommended prior knowledge and skills statement in Unit specifications in sequencing the delivery of Units. For example, the Single Phase A.C. Circuits Unit would normally be delivered before the Electrical Networks and Resonance. Examples of a full-time HNC Electrical Engineering and 2nd Year HND Electrical Engineering timetables are shown in Appendix 1.

One of the key reasons the HN Electrical Development Team has sought to reduce the time candidates have to spend on summative Unit assessment is to provide lecturers with more time to deliver Units. Lecturers are encouraged, in particular, to use this additional time to reinforce learning in core electrical principles and technologies and enhance the development of candidates' practical electrical skills.

Lecturers may use a variety of teaching and learning approaches in delivering the Units in the HNC and HND Electrical Engineering awards. These may include lecturing, group work, laboratory and practical work, computer simulation (using appropriate software packages), 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 encouraged wherever possible to provide 'real life' industrial examples of the application of the theory and practice learnt in the classroom, laboratory or workshop.

The HN Electrical Development Team recognises the very important role computer simulation, such as electrical installation software, plays in the modern electrical industry. The Team would actively encourage the use of computer simulation wherever appropriate but not at the expense of candidates doing practical work. The Team believe it is very important that candidates get as much exposure as possible to practical electrical hand skills, the use of electrical and electronic test equipment and other practical electrical activities if they are to be suitably prepared to work in industry.

Lecturers should also seek opportunities to integrate Core Skills within their teaching and learning programmes. Such opportunities may include 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 in the HND Electrical Engineering Graded Unit project
- ◆ Develop complex, vocationally specific reading skills (eg Electrical Safety, Industrial Plant Maintenance etc)
- ◆ Develop report writing skills in a number of Units (eg Electrical Power Systems, Three Phase Induction Motors etc)
- ◆ Allowing candidates to develop their Communication skills in group work activities (eg Communication: Practical Skills, Electrical Safety)

Numeracy

- ◆ Reinforcing Numeracy and Mathematical skills when teaching electrical engineering topics (eg Electrical Machine Principles, Electrical Networks and Resonance, Synchronous Machines etc)
- ◆ Reinforcing Using Graphical information skills by use of a range of graphical representations (eg Power Electronics, Fundamentals of Control Systems and Transducers etc)

Information Technology

- ◆ Develop Information Technology skills through the application of IT within an Electrical Engineering context (eg Control Systems Behaviour, Electrical Installation Design: Computer Aided etc)

Problem Solving Skills

- ◆ Develop Critical Thinking Skills through the application of electrical engineering principles and technologies to solve electrical engineering problems
- ◆ Develop Planning and Organisational skills (eg Utilisation of Electrical Energy in Buildings, Industrial Plant Maintenance etc)
- ◆ Develop reviewing and evaluation skills through, for example, the review and evaluation of the Outcomes of assignments and project work (eg Applications of Power Electronics in Electrical Motor Drive Systems, Electrical Standby Systems etc)

Working with Others

- ◆ Develop Working with Others skills through group discussion on the solution to electrical engineering problems (eg Electrical Safety — role play scenario: eg issuing a Permit to Work, identifying risk factors) and laboratory and project work (eg Analogue Electronics: An Introduction, Digital Electronics etc)

6.3 Assessment

From the outset of developments the HN Electrical Development Team recognised the need to have an appropriate assessment strategy in place for the HNC and HND Electrical Engineering awards. Such a strategy was developed and is shown below:

Aims

To ensure that:

- (1) consistent, rigorous and efficient approaches are adopted to the development and administration of HN Electrical Engineering assessment instruments at both Unit and Graded Unit levels, 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 moderation processes are put in place in order to ensure that consistent national standards are achieved for all HN Electrical Engineering assessments.

Objectives

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

- (1) Develop nationally at least one assessment exemplar pack for each mandatory Unit, which clearly sets out the standards of assessment expected in the Unit.
- (2) Adopt a holistic approach to Unit assessment. The implications of this are as follows:
 - (i) Assessment instruments will normally be designed only to sample knowledge and skills in a Unit (this is consistent with the new HN Unit format)
 - (ii) A Unit assessment strategy will be adopted, where possible, to produce a single assessment instrument for the whole Unit. Where this is not possible the assessment strategy will seek to ensure that the minimum number of assessment instruments required are consistent with maintaining agreed national standards.
- (3) Whilst not seeking to be entirely prescriptive with regard to the time spent on assessment in each HN Unit, over assessment should be avoided. Assessment times are clearly stated in the individual Unit Specifications.
- (4) Produce assessment exemplar packs for the two Graded Units. For the Graded Unit examination produce at least one sample exam paper to show the standards expected in such a paper. Likewise, for the 2 credit Graded Unit Electrical Engineering Project produce a set of materials which clearly set out the standards of candidate response required to achieve a Grade A and a Grade C.
- (5) Actively encourage centres to work in partnership in producing Graded Unit assessment materials, which meet nationally agreed standards reducing, in turn, the workload on staff in individual colleges.
- (6) Ensure that consistent and rigorous internal and external moderation procedures operate through both HN Unit level and Integrative 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 exemplar and Graded Unit materials.

Assessment Loading Grid

An Assessment Loading Grid showing the type and duration of assessment in each Unit is shown in Appendix 2. It is hoped that course planners will find this grid helpful in timetabling the two awards.

Assessment Exemplar Materials

Assessment exemplar packs are in the process of being produced for all mandatory Units, and the Graded Units in the HNC and HND Electrical Engineering awards.

Graded Unit Assessment Exemplars

It is recommended that candidates do not sit the Graded Unit Examination until the end of the HNC (1st Year of the HND) given the range of Units that it draws from. It is recommended that, given the size and complexity of the project, that the Graded Unit Project is started at the beginning of the second year of the HND.

Formative Assessment

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

6.4 Re-assessment

The way in which centres reassess candidates is integral to the way they manage the award assessment process as a whole. Re-assessment should be subject to rigorous internal moderation in exactly the same way as assessment is.

Candidates may require to be reassessed on only a part of an assessment where their evidence has been generated over a period of time and/or a discrete part of the Unit, such as an Outcome, has been assessed originally. On other occasions it may not be possible to reassess candidates on parts of their performance which are unsatisfactory. Situations where candidates may have to re-do a whole assessment include:

- ◆ assessments which test knowledge and understanding and where it may not be possible to extract some of the items for reassessment purposes
- ◆ where parts of several Outcomes are involved
- ◆ where a project has been designed as an integral assessment and where there is requirement to complete the project as a single complex task

Re-assessment Opportunities

Reassessment should operate in accordance with a centre's assessment policy and the professional judgement of the assessor. SQA advises that there should normally be one, or in exceptional circumstances two, reassessment opportunities. Please refer to SQA's *Guide to Assessment and Quality Assurance for Colleges of Further Education, August 2003 revisions*.

Developing Alternative Assessments

The design of original assessments should inform the reassessment process to a large extent, as the original determines the type of assessment instruments used and the purpose of the assessment. It is normal practice for centres to build up a bank of assessments which can be used in whole or in part for reassessment purposes.

Assessment writers should always refer to the Unit specification when developing an alternative assessment to ensure that it is of equal demand to the original assessment and that it covers all the necessary criteria. Where candidates have not provided satisfactory evidence for knowledge and/or skills items which have been sampled, they should be reassessed on a different sample.

Re-assessing HN Graded Units

Reassessment of the Electrical Engineering: Graded Unit 1 should be based on an alternative examination paper. Re-assessment of Electrical Engineering: Graded Unit 2 should normally entail a candidate undertaking a completely new project. Where a candidate marginally fails the Electrical Engineering: Graded Unit 2 the centre may wish to reassess her/him on that part(s) of the performance which was unsatisfactory. Such reassessment would be at the discretion of the centre and should be subject to rigorous internal moderation.

7 Guidance for centres

7.1 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.

7.2 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* (www.sqa.org.uk)

7.3 Assessment moderation

All assessment instruments used within the HNC and HND Electrical Engineering awards should be internally moderated, including assessment exemplar materials, using appropriate policies within the centre and guidelines provided by SQA. This will ensure the validity and reliability of the instruments of assessment used within the centre.

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

For further information on internal and external moderation refer to the *SQA Guide to Assessment and Quality Assurance for Colleges of Further Education*, August 2003 revision.

7.4 Open and Distance Learning

Advice on the use of open and distance learning is given in individual Unit specifications. However, where it is used with regard to assessment, planning would be required by the centre concerned to ensure the sufficiency and authenticity of candidate evidence. Arrangement 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 a Unit 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 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.

7.5 Special needs

The two awards have been designed to ensure that there are no artificial barriers to learning or assessment. Centres will need to take account of the special needs of individual candidates when planning learning experiences, selecting assessment instruments or considering special alternative Outcomes for Units. SQA is currently reviewing a guidance document on special assessment arrangements.

7.6 Credit transfer Arrangements

A document entitled Credit Transfer Grids has been developed which contains information on credit transfer arrangements between old HN Electrical Units (those developed as part of the 1996 HN Engineering developments) and the new HN Electrical Units (the Units written as part of this development). A copy of this document can be found in Appendix 3. This document has been designed to make it as straightforward as possible for course admission tutors to work out the level of credit transfer a candidate with 'old' HN Units or an 'old' HNC Engineering: Electrical award can count towards the new HNC and HND Electrical Engineering awards. As a number of Units in the HNC and HND Electrical Engineering awards are common to the HNC and HND Electronics awards course admission tutors may also have to use the Credit Transfer Document developed for the HNC and HND Electronics awards to determine a candidates full credit transfer score. This information is contained within the HNC/D Electronics Arrangements Document which can be downloaded from the SQA website. The use of these documents is illustrated as follows.

An Example of the use of the Guide to Credit Transfer Document

A candidate has an HNC Engineering: Electrical having successfully achieved the list of Units shown below. She now wishes to study for a new HND Electrical Engineering award. A course admission tutor has been given the task of determining the level of credit transfer the candidate has towards the HND Electrical Engineering award.

List of Units successfully achieved as part of the HNC Engineering: Electrical

Unit number	Unit title
A6AN 04	Information Technology Applications 2
D5P3 04	Communication: Presenting Complex Communication for Vocational Purposes
BA24 04	Fundamentals of Quality Assurance
D4H7 04	Engineering Project
D4JH 04	Mathematics for Engineering
D4L9 04	Single Phase AC Networks
D4LK 04	Three Phase Systems
D4LJ 04	Three Phase Induction Motors
D4LE 04	Supply Systems, Composite Loads and Tariffs
D4GM 04	Electrical Safety and Work Permits
D4LS 04	Utilisation of Electrical Energy

New Unit Title	New Unit Code	Old Unit Title	Old Unit Code	Credit Transfer Conditions
Engineering Mathematics 1	H7K0 33	Mathematics for Engineering 1:Electronics and Electrical	DG4H 33	To gain credit transfer to the new unit candidates will have to provide additional evidence relating to functions as specified in the Evidence requirements in respect of the first three knowledge/skills in Outcome 1 and relating to vectors as specified in the first three knowledge/skills in outcome 3.
Engineering Mathematics 1	H7K0 33	Mathematics for Engineering 1:Mechanical and Manufacturing	DT5X 33	To gain credit transfer to the new unit candidates will have to provide additional evidence relating to functions as specified in the Evidence requirements in respect of the first three knowledge/skills in Outcome 1 and relating to 3D vectors and complex numbers as specified in the knowledge/skills in outcome 3.

New Unit Title	New Unit Code	Old Unit Title	Old Unit Code	Credit Transfer Conditions
Engineering Mathematics 2	H7K1 34	Mathematics for Engineering 2	DG4L 34	To gain credit transfer to the new unit candidates will have to provide additional evidence relating to trigonometric and hyperbolic functions as specified in the Evidence requirements in respect of Outcome 1.

Credit Transfer Available to Candidate (using Credit Transfer Documents)

Old Unit title	New Unit title	Credit value	Status (Full, Partial or No Credit Transfer)
Information Technology Applications 2	Information Technology: Applications Software 1	1	Full
Communication: Presenting Complex Communication for Vocational Purposes	Communication: Practical Skills	1	Partial Outcomes 2 and 3
Fundamentals of Quality Assurance	Quality Management: An Introduction		20%
Engineering Project			None*

Old Unit title	New Unit title	Credit value	Status (Full, Partial or No Credit Transfer)
Mathematics for Engineering	Mathematics for Engineering 1: Electronics and Electrical		Partial Outcomes 1 and 2 of Mathematics for Engineering Unit only (although candidate could get full credit if they have analysed trigonometrical functions and their graphs elsewhere)
Single Phase A.C. Networks	Single Phase A.C. Circuits	1	Full Particularly where a candidate has successfully achieved a number of NQ Electrical Principles Units
Three Phase Systems	Three Phase Systems	1	Full
Three Phase Induction Motors	Three Phase Induction Motors	1	Full
Supply Systems, Composite Loads and Tariffs	Electricity Power Systems		60%
Electrical Safety and Work Permits	Electrical Safety	1	Full
Utilisation of Electrical Energy	Utilisation of Electrical Energy in Buildings. Not in HNC Electrical Engineering but would count one credit towards HND Electrical Engineering	1	Full
	Total	7	

The candidate can obtain seven full credits plus a number of partial credits towards the HND Electrical Engineering using the credit transfer documents.

*With reference to the new two credit, Electrical Engineering: Graded Unit 2 (Electrical Project) the HN Electrical Development Team has taken the view that the old Engineering Project cannot be counted for credit transfer purposes towards the new Graded Unit 2 because it contains no mechanism for grading candidates on the A, B or C scale.

7.7 General information for candidates

The new HNC and HND Electrical Engineering awards have been designed by an expert team of educators and industrialists with a view to allowing you to meet the educational requirements to work as an electrical incorporated engineer. The two new qualifications contain up-to-date and relevant electrical subject content and skills and have also been designed to satisfy the new SQA Higher National Design Principles.

The HN Electrical Development Team has designed the two new awards so that you will have opportunities to learn and understand the core principles and technologies that underpin Electrical Engineering. Learning these will be essential in providing you with a platform for tackling many electrical tasks and in allowing you to develop a more in-depth knowledge of Electrical Engineering. At the same time studying the new HNC and HND Electrical Engineering awards will provide you with opportunities to develop sound practical electrical investigation, construction, testing and project skills which are critical to being a good electrical technician and/or incorporated engineer.

As well as studying Electrical subjects you will also take Communication with an option to do Information Technology as part of the HNC. Good Communication skills are essential to understanding technical material, and when communicating with others whether on an individual basis or when working as part of a team. Information Technology underpins much of the work in Electrical Engineering whether this is through computer simulation of electrical and electronic circuits or systems or in preparing a written report on the work you have been involved in.

Opportunities to develop Information Technology knowledge and skills are available in a number of Units in the HNC, but an optional Unit on Information Technology Applications is also available if you wish to consolidate your skills in this area.

The Communication and Information Technology Units are mandatory within the HND Electrical Engineering award although you will not need to study these Units if you have already done so as part of the HNC. There is an additional mandatory core Unit in the HND Electrical Engineering award entitled Business Awareness and Continuing Professional Development. This Unit will provide you with an awareness of the business pressures on modern electrical companies and what strategies they are adopting to meet these pressures. The Unit will also provide you with the opportunity to develop your own career and education action plan for the next five years or so.

As already mentioned Electrical Engineering is very much about learning and understanding core principles and technologies whilst also doing practical work such as constructing and testing circuits and project work. Thus, while taking the HNC and HND Electrical Engineering awards you can anticipate that the teaching and learning approaches adopted by your lecturers will include the following: lecturing, group work, practical electrical and electronics work, inspection and testing, computer simulation of circuits and installations and project work.

The Electrical Development Team has ensured that assessments in the two awards meet national standards. The two awards have been designed to optimise assessment so that sufficient time is available for you to learn the electrical principles and technologies and the practical skills that are essential to being a good electrical technician and incorporated engineer.

You can expect to do assessment at individual Unit level and at qualification level. At Unit level assessment will consist of some form of written end test, or a combination of short written test and practical exercise or a purely practical exercise. Your lecturer should tell you at the start of the Unit what form the Unit assessment will take. In addition, to Unit tests there will also be a 3-hour examination at HNC level and a 2-credit project at HND level. Both these assessments have been designed to allow you to demonstrate your ability to integrate knowledge, understanding and skills learnt in the two awards as a whole.

The HN Electrical Development Team does not wish to place any artificial barriers in the way of potential candidates wanting to study the two awards. However, it would be unfair to enrol a candidate into the HNC and HND who did not have a realistic chance of successfully achieving either or both awards. The HN Electrical Development Team would therefore recommend that a candidate had one of the following qualifications before entering the HNC and HND Electrical Engineering:

- (1) One Higher from Physics, Technological Studies or Higher Mathematics and at least three Standard Grades 1-2/ Intermediate 2 passes including Mathematics, Physics/Technological Studies and English.
- (2) A National Certificate in Electrical Engineering or Electronic Engineering.
- (3) Equivalent qualifications or experience to those shown in (1) and (2).

An HNC or HND Electrical Engineering award no longer satisfies the full academic requirements to become an incorporated engineer (a Degree is now required). However, the new HNC and HND Electrical Engineering awards provide a very solid platform for candidates to proceed to the advanced stages of a Degree programme in Electrical Engineering. Ask your lecturer about progression arrangements your college has with any Universities.

7.8 Relationship to other awards

An HNC and HND Electronics were validated in 2004. Since a number of Units are common between HNC and HND Electrical Engineering and Electronics awards candidates will have opportunities to transfer a significant number of Units between the various awards. More limited opportunities will exist for candidates to transfer Units between the HNC and HND Electrical Engineering awards and awards in Mechanical Engineering, Manufacturing Systems, Mechatronics, General Engineering and Fabrication and Welding and vice versa.

7.9 Articulation Arrangements

All the universities in Scotland were contacted regarding possible articulation routes between the HNC and HND Electrical Engineering awards and Degree courses offered by the universities. In general terms, universities indicated that they will allow candidates with an HNC to enter the first year of their electrical engineering (or related engineering) Degrees programmes. Candidates with an HND will normally be allowed to enter the second year of a Degree programme provided they have the Unit, Mathematics for Engineering 3.

Appendix 1: HNC and HND Timetables

HNC: Guidelines for Delivery of Mandatory Units

(Also Year 1 of the HND Award)

Centre Year	Block 1	Block 2	Block 3	Block 4
Unit title				
Communication: Practical Skills				
Single Phase A.C. Circuits OR DC and AC Principles				
Three Phase Systems				
Electricity Power Systems				
Electrical Machine Principles				
Electrical Safety				
Mathematics for Engineering 1: Electronics and Electrical				
Application of Electrical and Electronic Instruments				
Electronic Instruments				
Electrical Engineering: Graded Unit 1				
Option 1				
Option 2				

It is recognised that timetabling in a four block system is not done by every centre. The above grid is therefore only a guide indicating the order of delivery of Units.

The HNC Units will normally make up the first year of the HND timetable.

HND: Guidelines for Delivery of Mandatory Units

(Year 2 of the HND Award)

Centre Year	Block 1	Block 2	Block 3	Block 4
Unit title				
IT: Applications Software				
Business Awareness and CPD				
Electrical Networks and Resonance				
Power Electronics				
Fundamentals of Control Systems and Transducers				
Mathematics for Engineering 2				
Transmission Lines and Complex Waves				
Electrical Installation Design				
Electrical Motor Drive Systems				
Transformers				
Utilisation of Electrical Energy in Buildings				

As with the previous HNC grid, it is recognised that timetabling in a four block system is not done by every centre. The above grid is therefore only a guide indicating the order of delivery of Units.

Centres may wish to spread the delivery of Units over more than one block which would allow more Units to be delivered in parallel.

Whichever delivery arrangement is used, it is important to complete the delivery of **ALL** the HND Units over the two years of a full-time programme.

Appendix 2: Assessment Loading Grid

HNC/HND Electrical Engineering Group Award

Summary Assessment Loading

HNC Electrical Engineering Mandatory Units

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
D77G 34	Communication: Practical Skills	Summary/Evaluation Assignment	---	Business Document Assignment	---	Spoken Communication Assignment	---
DG4H 33	Mathematics for Engineering 1: Electronics and Electrical	Written Question Paper	1 hour 40 mins				
DG54 34 <i>(finishes 31/07/2013)</i> FY9E 34	Single Phase A.C. Circuits OR DC and AC Principles	Written Question Paper	1 hour 30 mins				
DN47 34	Three Phase Systems	Written Question Paper	2 hours				
DN3W 34	Electricity Power Systems	Industrial Assignment	---	Written Question Paper	1 hour 30 mins		
DN4J 34 <i>(finishes 31/07/2012)</i> H01T 34	Electrical Machine Principles OR Electrical Machine Principles	Written Question Paper	2 hours	Written Question Paper	2 hours		
DN4L 34 <i>(finishes 31/07/2013)</i> H01V 34	Electrical Safety OR Electrical Safety	Written Question Paper	1 hour 30 mins	Permit-to-work Assignment	---		
DN48 33 <i>(finishes 31/07/2012)</i> H03B 33	Application of Electrical and Electronic Instruments OR Application of Electrical and Electronic Instruments	Written Question Paper	1 hour	Practical Assignment & Report	6 hours		
DN3V 34	Electrical Engineering: Graded Unit 1	Examination (1 credit)	3 hours				

Mandatory Section Assessment Summary:

Eight Written Question Papers (Total assessment time = 13 hours 10 mins) + Graded Unit 1 (Total assessment time = 3 hours) + six Assignments.

HNC Electrical Engineering Optional Units

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
DG3G 34	Electrical Networks and Resonance	Written Question Paper	1 hour 30 mins				
D75X 34	Information Technology: Applications Software 1	Project/Case Study Assignment					
DN42 34 (finishes 31/07/2013) FY9R 34	Power Electronics OR Power Electronics	Written Question Paper	1 hour 30 mins	Laboratory exercise	1 hour 30 mins		
DN41 34	Inspection and Testing of Low Voltage Electrical Installations	Written Question Paper	1 hour 30 mins	Practical Testing and Certification Assignment	---		
DG31 34	Application of Programmable Logic Controllers	Written Question Paper	1 hour 30 mins	PLC Simulated Assignment	---		
DN3T 34	Electrical Systems in Potentially Explosive and Gas Hazardous Environments	Written Question Paper	1 hour	Written Question Paper	1 hour		
DN3Y 34	Fundamentals of Control Systems and Transducers	Written Question Paper	2 hours	Laboratory exercise	2 hours		
DG4L 34	Mathematics for Engineering 2	Written Question Paper	1 hour 30 mins				
DN4H 34	Electrical Installation Skills	Identification/ Application Assignment	---	Practical Assignment	---	Practical Assignment	---
DT8Y 34	Quality Management: An Introduction	Written Question Paper	1 hour	Case Study Assignment	---	Case Study Assignment	1 hour
DN45 35	Three Phase Induction Motors	Written Question Paper	2 hours	Assignment Report	---		

HND Electrical Engineering Mandatory Units

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
D77G 34	Communication: Practical Skills	Summary/Evaluation Assignment	---	Business Document Assignment	---	Spoken Communication Assignment	---
D75X 34	Information Technology: Applications Software 1	Project/Case Study Assignment	---				
DG3D 35	Business Awareness and Continuing Professional Development	Case Study Assignment	---	CPD Action Plan Assignment	---		
DG4H 33	Mathematics for Engineering 1: Electronics and Electrical	Written Question Paper	1 hour 40 mins				
DG54 34 <i>(finishes 31/07/2013)</i> FY9E 34	Single Phase A.C. Circuits OR DC and AC Principles	Written Question Paper	1 hour 30 mins				
DN47 34	Three Phase Systems	Written Question Paper	2 hours				
DN 3W 34	Electricity Power Systems	Industrial Assignment	---	Written Question Paper	1 hour 30 mins		
DN4J 34 <i>(finishes 31/07/2013)</i> H01T 34	Electrical Machine Principles OR Electrical Machine Principles	Written Question Paper	2 hours	Written Question Paper	2 hours		
DN4L 34 <i>(finishes 31/07/2013)</i> H01V 34	Electrical Safety OR Electrical Safety	Written Question Paper	1 hour 30mins	Permit-to-work Assignment	---		
DN48 33 <i>(finishes 31/07/2013)</i> H03B 33	Application of Electrical and Electronic Instruments OR Application of Electrical and Electronic Instruments	Written Question Paper	1 hour	Practical Assignment and Report	6 hours		
DG3G 34	Electrical Networks and Resonance	Written Question Paper	1 hour 30 mins				

HND Electrical Engineering Mandatory Units (cont)

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
DN42 34 <i>(finishes 31/07/2013)</i> FY9R 34	Power Electronics OR Power Electronics	Written Question Paper	1 hour 30 mins	Laboratory exercise	1 hour 30 mins		
DN3Y 34	Fundamentals of Control Systems and Transducers	Written Question Paper	2 hours	Laboratory Exercise	2 hours		
DG4L 34	Mathematics for Engineering 2	Written Question Paper	1 hour 30 mins				
DG57 35	Transmission Lines and Complex Waves	Written Question Paper	2 hours				
DN4F 35 <i>(finishes 31/07/2013)</i> FY7L 35	Electrical Installation Design OR Electrical Installation Design	Written Question Paper	2 hours	Project-based Assignment	---		
DN4K 35	Electrical Motor Drive Systems	Written Question Paper	2 hours	Investigation Assignment	---		
DN49 35	Transformers	Written Question Paper	2 hours	Laboratory/Case Study Investigation Assignment	1 hour		
DN4A 35	Utilisation of Electrical Energy in Buildings	Design Scheme Assignment	---	Design Scheme Assignment	---	Design Scheme Assignment	---
DN3V 34	Electrical Engineering: Graded Unit 1	Examination (1 credit)	3 hours				
DN3X 35	Electrical Engineering: Graded Unit 2	Project (2 credits)	---	---	---	---	---

Mandatory Section Assessment Summary:

16 Written Question Papers (Total assessment time = 27 hours 40 mins)

+ Graded Unit 1 (Total assessment time 3 hours)

+ 17 Assignments

+ Graded Unit 2 (2 credit project)

HND Electrical Engineering Optional Units

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
DN41 34	Inspection and Testing of Low Voltage Electrical Installations	Written Question Paper	1 hour 30 mins	Practical Testing and Certification Assignment	---		
DG31 34	Application of Programmable Logic Controllers	Written Question Paper	1 hour 30mins	PLC Simulated Assignment	---		
DN3T 34	Electrical Systems in Potentially Explosive and Gas Hazardous Environments	Written Question Paper	1 hour	Written Question Paper	1 hour		
DN46 33	Analogue Electronics: An Introduction	Written Question Paper	1 hour 30 mins	Practical Assignment	2 hours 30 mins		
DN4E 34	Digital Electronics	Written Question Paper	2 hours	Practical Assignment	2 hours		
DT8Y 34	Quality Management: An Introduction	Written Question Paper	1 hour	Case Study Assignment	---	Case Study Assignment	1 hour
DN4H 34	Electrical Installation Skills	Identification/ Application Assignment	---	Practical Assignment	---	Practical Assignment	---
DN40 34	Industrial Plant Maintenance	Written Question Paper	1 hour 30 mins	Maintenance Plan Assignment	---		
DG58 34	High Level Engineering Software	Log/Portfolio Assignments	---				
D77H 34	Employment Experience 2	Portfolio Assignments	---				

HND Electrical Engineering Optional Units (cont)

Product Code	Product title	Assessment 1		Assessment 2		Assessment 3	
		Type	Time	Type	Time	Type	Time
DN4D 35	Control Systems Behaviour	Written Question Paper	1 hour	Simulated Control Assignment	6 hours		
DG4P 35	Mathematics for Engineering 3	Written Question Paper	2 hours 30 mins				
DG50 35	Power Supply Circuits	Written Question Paper	1 hour 30 mins	Practical Assignment	---		
DN43 35	Switchgear and Protection of High Voltage Systems	Written Question Paper	2 hours	Assignment Report	---		
DN4C 35	Applications of Power Electronics in Electrical Motor Drive Systems	Written Question Paper	1 hour 30 mins	Assignment Report	---		
DN45 35	Three Phase Induction Motors	Written Question Paper	2 hours	Assignment Report	---		
DN44 35	Synchronous Machines	Written Question Paper	2 hours				
DN4M 35	Electrical Standby Systems	Written Question Paper	2 hours				
DN4G 35	Electrical Installation Design: Computer Aided	Design Assignment	---				

Appendix 3: Credit Transfer Document

HN Unit Credit Transfer Grid

HN Unit: Analogue Electronics: An Introduction

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN46 33 Analogue Electronics: An Introduction	1	Explain the characteristics and operation of a range of analogue electronic devices	D4FF 04 Analogue Electronic Devices	1	Analyse the operating characteristics and applications of semiconductor diodes	Outcomes 1,2 and 3 if the OLD Unit consider the properties and operation of a range of analogue devices. i.e Diodes (1) Bipolar transistors (2) and FETs (3).	33% credit transfer from OLD to NEW Unit
	2	Describe the applications of a range of analogue electronic devices		2	Analyse the properties and operation of npn and pnp bipolar transistors	Outcome 1 of the OLD Unit also considers applications of DIODES but NO applications are provided for Bipolar Transistors and FETs.	
	3	Demonstrate the applications of a range of analogue electronic devices		3	Analyse the properties and operation of field effect transistors	The OLD Unit does NOT require any practical work to be carried out.	

Credit Transfer Recommendations

A candidate in possession of the OLD Unit, Analogue Electronic Devices, should be awarded 33% (Outcome 1) credit transfer to the NEW Unit, Analogue Electronics: An Introduction. This relates the Outcomes of the OLD Unit to Outcome 1 of the NEW Unit dealing with the operation and characteristics of diodes, bipolar transistors and FETs.

Outcomes 2 (describe applications) and 3 (demonstrate applications) of the NEW Unit are not covered in the OLD Unit and must therefore be taught and assessed.

HN Unit Credit Transfer Grid

HN Unit: Application of Electrical and Electronic Instruments

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN48 33 Application of Electrical and Electronic Instruments	1	Function and effects of instruments on their circuits	D4H1 04 Electronic Test Instruments	1	Use analogue and digital multimeters on electronic circuits	<p>Outcome 2 of the new Unit is similar to Outcome 1 of the old Unit however the new Unit relates to ELECTRICAL values rather than Electronic quantities.</p> <p>Outcome 3 of the new Unit considers both analogue and digital oscilloscopes on ELECTRICAL circuits whereas Outcome 2 of the old Unit deals only with CROs on Electronic circuits.</p> <p>There are NO further areas of overlap between the two Units.</p>	No credit transfer. Candidates are recommended to undertake the new Unit.
	2	Use of analogue and digital multimeters on electrical circuits		2	Use of the CRO in electronic circuits		
	3	Use of oscilloscopes on electrical circuits		3	Funct. Gens. and freq. counters in electronic circuits		
	4	Use electrical Installation test instruments		4	Digital test instruments in logic circuits		

HN Unit Credit Transfer Grid

HN Unit: Control Systems Behaviour

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4D 35 Control Systems Behaviour	1	Demonstrate the modelling of closed-loop systems	A4RP 04 Control System Theory	1	Demonstrate the modelling of closed-loop systems	All Outcomes of the new Unit are similar to the old Unit.	100% credit transfer from OLD to NEW Unit.
	2	Predict the transient and steady-state behaviour of closed-loop systems		2	Predict the transient and steady-state behaviour of closed-loop systems		
	3	Apply frequency response methods to the analysis of control systems		3	Apply frequency response methods to the analysis of control systems		
	4	Apply three term controllers to closed-loop control systems		4	Apply three term controllers to closed-loop control systems		

HN Unit Credit Transfer Grid

HN Unit: Digital Electronics

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4E 34 Digital Electronics	1	Produce truth tables and Boolean expressions for logic gates	D4FR 04 Combinational Logic	1	Describe the characteristics of comb. digital logic functions	<p>The NEW Unit is based on two OLD Units namely ‘Combinational Logic’ and ‘Sequential Logic.’</p> <p>Outcome 2 of the NEW Unit is fully covered by criteria from Outcomes 1 and 3 of the OLD ‘Combinational Logic’ Unit.</p> <p>Criteria from Outcome 4 of the OLD ‘Combinational Logic’ Unit relate to Outcome 4 of the NEW Unit however this is not considered to be sufficient to give credit transfer for this Outcome.</p>	See Notes on following page.
	2	Design Combinational Logic circuits using minimisation techniques		2	Explain features of logic families		
				3	Design and simulate a comb. logic circuit using Karnaugh maps		
				4	Build and test a combinational logic circuit		

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4E 34 Digital Electronics (cont'd)	3	Describe the operation of sequential logic circuits	D4L7 04 Sequential Logic	1	Explain the principles of operation of sequential circuits	Outcome 3 of the NEW Unit is fully covered by criteria from Outcomes 1, 2 and 3 of the OLD 'Sequential Logic' Unit.	See Notes Below
				2	Analyse simple sequential logic devices		
				3	Design and implement synchronous sequential circuits using bistables		
	4	Design and implement synchronous sequential circuits using MSI chips					
	4	Construct logic circuits					

Credit Transfer Recommendations

A candidate in possession of BOTH OLD Units 'Combinational Logic' and 'Sequential Logic' should be awarded 50% Credit Transfer to the NEW Unit 'Digital Electronics. This credit transfer relates to Outcomes 2 and 3 of the NEW Unit. Outcomes 1 (Truth Tables and Boolean Expressions) and 4 (Construct Logic Circuits) of the NEW Unit will still require to be taught and assessed.

A candidate in possession of the OLD Unit 'Combinational Logic' should be awarded 25 % Credit Transfer to the NEW Unit 'Digital Electronics. This credit transfer relates to Outcome 2 of the NEW Unit. Outcomes 1 (Truth Tables and Boolean Expressions), 3 (Operation of Sequential Circuits) and 4 (Construct Logic Circuits) of the NEW Unit will still require to be taught and assessed.

A candidate in possession of the OLD Unit 'Sequential Logic' should be awarded 25% Credit Transfer to the NEW Unit 'Digital Electronics. This credit transfer relates to Outcomes 3 of the NEW Unit. Outcomes 1 (Truth Tables and Boolean Expressions), 2 (Design Minimised Combinational Logic Circuits) and 4 (Construct Logic Circuits) of the NEW Unit will still require to be taught and assessed.

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4F 35 Electrical Installation Design	1	Analyse the overcurrent protection arrangements of circuits in an electrical installation	D4GW 04 Electrical Installation Design	1	Make an assessment of general characteristics for electrical installations in commercial and industrial premises in accordance with current standards		100% credit transfer from OLD to NEW Unit.
	2	Analyse the earthing requirements of electrical installations in compliance with BS 7671		2	Carry out design calculations for electrical installations in accordance with current standards		
	3	Analyse cable sizing for given circuit conditions in an electrical installation in compliance with BS 7671		3	Plan and design an electrical installation for industrial premises in accordance with current standards		
	4	Execute a design exercise for an electrical installation in compliance with BS 7671					

HN Unit Credit Transfer Grid

HN Unit: Electrical Installation Design: Computer Aided

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4G 35 Electrical Installation Design: Computer Aided	1	Develop electrical schematic diagrams	D4GV 04 Electrical Installation Design: Computer Aided	1	Develop electrical schematic diagrams		100% credit transfer from OLD to NEW Unit.
	2	Perform electrical installation design calculations using computer software		2	Perform electrical installation design calculations using computer software		
	3	Produce electrical installation design reports		3	Produce electrical installation design reports		

HN Unit Credit Transfer Grid

HN Unit: Electrical Installation Skills

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4H 34 Electrical Installation Skills	1	Identifies domestic and industrial components and their application	D4GR 04 Electrical Installation and Commissioning Skills	1	Recognises components used in electrical installations	The only real difference between the two unit is the introduction of the application of the components in Outcome 1.	100% credit transfer
	2	Install and Test Domestic Electrical Installation Circuits		2	Interpret different types of electrical wiring arrangements		
	3	Install and Test an Industrial Electrical Installation Circuit		3	Installs an electrical installation		

HN Unit Credit Transfer Grid

HN Unit: Electrical Safety

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4L 34 Electrical Safety	1	Explain features of an operational plan for safe working	D4GM 04 Electrical Safety and Work Permits	1	Create an operational plan for safe working	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit and full credit transfer from old to new is recommended.	100% credit transfer from OLD to NEW Unit.
	2	Explain features of elect. dist and need for protection and isolation		2	Explain features of elect. dist and need for protection and isolation	Outcomes 2 and 3 of the new Unit are identical to those of the old Unit.	
	3	Explain features of work permit system for safe working on isolated networks		3	Explain features of work permit system for safe working on isolated networks	Outcome 4 of the new Unit is very similar to Outcome 4 of the old Unit and full credit transfer from old to new is recommended.	
	4	Produce PTW documentation to current standards		4	Demonstrate PTW procedures to current standards		

HN Unit Credit Transfer Grid

HN Unit: Electricity Power Systems

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN3W 34 Electricity Power Systems	1	Demonstrate knowledge of Electricity Supply Systems	D4LE 04 Supply Systems, Composite Loads and Tariffs	1	Explain supply systems.	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit. Full credit transfer from old to new is recommended.	50% credit transfer from OLD to NEW Unit.
	2	Explain power quality		2	Evaluate cable and transformer loading.	Outcome 2 of the new Unit is not covered in the old Unit.	
	3	Analyse power system faults		3	Explain supply tariffs for industrial consumers.	Outcome 3 of the new Unit is not covered in the old Unit.	
	4	Solve power factor improvement problems.		4	Evaluate power, heat and light costs for various tariffs to industrial premises.	Outcome 4 of the new Unit is covered by material in Outcomes 3 and 4 of the old Unit. Full credit transfer from old to new is recommended.	

Credit Transfer Recommendations

A candidate in possession of old Unit 'Supply Systems, Composite Loads and Tariffs' could be awarded 50% credit transfer to new Unit 'Electricity Power Systems'. Outcomes 2 and 3 of the new Unit would be required to be taught and assessed.

Note: Outcome 3 of this new Unit is covered by material in Outcome 3 of an additional old Unit 'Protection and Metering'. A candidate in possession of this additional old Unit could be awarded full credit transfer for Outcome 3.

HN Unit Credit Transfer Grid

HN Unit: Fundamentals of Control Systems and Transducers

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN3Y 34 Fundamentals of Control Systems and Transducers	1	Explain control system elements and signals	D4G5 04 Control Fundamentals	1	Explain system components and signals	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit Control Fundamentals and full credit transfer from old to new is recommended. Outcome 2 of the new Unit is very similar to the combined two Outcomes of the old Unit Transducers and full credit transfer from old to new is recommended. Outcome 3 of the new Unit is very similar to Outcome 2 of the old Unit Control Fundamentals and full credit transfer from old to new is recommended.	See notes below table.
	2	Explain the operation and application of a range of transducers used in control systems		2	Describe the structure and behaviour of control systems		
	3	Describe the structure and behaviour of control systems	D4LM 04 Transducers	1	Explain the basic principles of operation of transducers		
	4			2	Describe the use and operation of transducers in measurement systems		

Credit Transfer Recommendations

A candidate in possession of **both** old Units Control fundamentals and Transducers should be awarded 100% credit transfer to new Unit Fundamentals of Control Systems and Transducers.

A candidate in possession of old Unit Control Fundamentals should be awarded 67% credit transfer to new Unit Fundamentals of Control Systems and Transducers. Outcome 2 of the new Unit would be required to be taught and assessed.

A candidate in possession of old Unit Transducers should be awarded 33% credit transfer to new Unit Fundamentals of Control Systems and Transducers. Outcomes 1 and 3 of the new Unit would be required to be taught and assessed.

HN Unit Credit Transfer Grid

HN Unit: Electrical Systems in Potentially Explosive and Gas Hazardous Environments

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN3T 34 Electrical Systems in Potentially Explosive and Gas Hazardous Environments	1	Properties of materials and hazards	D4GS 04 Electrical Installation: Equipment in Potentially Explosive and Hazardous Atmospheres	1	Properties of materials and hazards	<p>There is complete matching of the NEW Unit with the first four Outcomes of the OLD Unit.</p> <p>Any candidate who has achieved the OLD Unit may claim full credit transfer to the NEW Unit.</p>	100% credit transfer from OLD to NEW Units.
	2	Structure and codes of practice. Certification and testing.		2	Structure and codes of practice. Certification and testing.		
	3	Constructional features for Power equipment		3	Constructional features for Power equipment		
	4	Operation of Intrinsically safe equipment		4	Operation of Intrinsically safe equipment		
				5	Prepare inspection schedules		
				6	Implement inspection practices		

HN Unit Credit Transfer Grid

HN Unit: Industrial Plant Maintenance

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN40 34 Industrial Plant Maintenance	1	Explain standard techniques involved in plant maintenance	D4HX 04 Industrial Plant Maintenance	1	Analyse maintenance planning in relation to industrial plant and services	Outcome 1 in new Unit covers some material not common to old Unit; therefore approx 50% of Outcome 1 would be covered in the old.	30% credit transfer from OLD to NEW Units. It is recommended that candidates complete the new Unit.
	2	Describe typical health and safety regulations pertaining to plant maintenance systems		2	Analyse the organisation of maintenance for industrial plant and services	Outcome 2 of the new Unit has no real equivalent in the old and would have to be completed in full.	
	3	Devise a maintenance strategy for a given industrial scenario		3	Use planning techniques for the control and programming of maintenance work	Outcome 3 in the new Unit involves completing a maintenance plan and an introduction to CMMS software; Approx 50% of Outcome 3 would be covered by Outcomes 2 and 3 in the old Unit.	

HN Unit Credit Transfer Grid

HN Unit: Inspection and Testing of Low Voltage Electrical Installations

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN41 34 Inspection and Testing of Low Voltage Electrical Installations	1	Explain the general requirements for the inspection and testing of an electrical installation during its normal life-cycle	D4J2 04 Inspection and Testing of Low Voltage Electrical Installations	1	Explain the general requirements for the inspection and testing of an electrical installation during its normal life-cycle	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit and full credit transfer from old to new is recommended.	A candidate in possession of the old Unit Inspection and Testing of Low Voltage Electrical Installations should be awarded 100% credit transfer to the new Unit Inspection and Testing of Low Voltage Electrical Installations
	2	Explain the recommended tests to verify the integrity of an electrical installation		2	Explain the recommended tests to verify the integrity of an electrical installation	Outcome 2 of the new Unit is very similar to Outcome 2 of the old Unit and full credit transfer from old to new is recommended.	
	3	Explain the requirements and precautions for testing electrical installations		3	Explain the requirements and precautions for testing electrical installations	Outcome 3 of the new Unit is very similar to Outcome 3 of the old and full credit transfer from old to new is recommended.	
	4	Carry out appropriate testing procedures which conform to British Standard requirements		4	Carry out appropriate testing procedures which conform to British Standard requirements	Outcome 4 of the new Unit is very similar to Outcome 4 of the old Unit and full credit transfer from old to new is recommended.	

HN Unit Credit Transfer Grid

HN Unit: Power Electronics

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN42 34 Power Electronics	1	Analyse the construction characteristics and applications of power electronic devices	D4JA 04 Introduction to Power Electronics	1	Explain the operation of thyristors	Outcome 1 and Outcome 2 in the old Unit partially covers Outcome 1 in the new Unit (areas covered: thyristor, gate turn-off thyristor, triacs and power MOSFET).	50% credit transfer from OLD to NEW Units. This recommended credit transfer is at the discretion of the centre.
	2	Outline arrangements for the protection of and the dissipation of heat from power electronic devices		2	Explain the operation of power transistors	Outcome 3 in the old Unit partially covers Outcome 2 in the new Unit. Outcome 3 in the new Unit is partially covered in Outcome 1 of the old Unit.	
	3	Analyse the operation and applications of single phase convertors		3	Describe techniques for the safe operation of power electronic systems		
	4	Analyse the operation and applications of dc to dc choppers		4	Test and diagnose faults in a power electronic system		

HN Unit Credit Transfer Grid

HN Unit: Switchgear and Protection of High Voltage Systems

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes	Matching Comments	Credit Transfer Rec/mend
DN43 35 Switchgear and Protection of High Voltage Systems	1	Explain the need for protection devices in high voltage systems	D4L0 04 Protection and Metering	1 Explain the operation of protection schemes 2 Explain metering systems 3 Explain the effects of faults on a three phase system	Outcome 1 of the new Unit is covered in various Outcomes if the old Unit Protection and Metering. Full credit transfer is recommended.	See notes below table
	2	Explain distribution substation feeder protection schemes		1 Outline the function of sub-station equipment 2 Explain sub-station layouts	Outcome 2 of the new Unit is not fully covered in either of the old Units.	
	3	Explain construction, operation and application of switchgear	D4LD 04 Sub-Station Layout and Equipment	3 Draw up sub-station layouts from given specifications 4 Explain the selection and construction of switchgear for substations with a voltage up to and including 11 kV	Outcome 3 of the new Unit is similar to the combined Outcomes 4 and 5 of the old Unit Sub-station Layout and Equipment. Full credit transfer is recommended.	
	4	Explain operation and application of protection schemes		5 Explain the operation of switchgear used within sub-stations up to and including 11 kV	Outcome 4 of the new Unit is not fully covered in either of the old Units.	

Credit Transfer Recommendations

HN Unit: Switchgear and Protection of High voltage Systems

A candidate in possession of **both** old Units 'Protection and Metering' and 'Sub-station Layout and Equipment' could be awarded 50% credit transfer to new Unit 'Switchgear and Protection of High Voltage Systems'. Outcomes 2 and 4 of the new Unit would be required to be delivered and assessed.

A candidate in possession of old Unit 'Protection and Metering' could be awarded 25% credit transfer to new Unit 'Switchgear and Protection of High Voltage Systems'. Outcomes 2, 3 and 4 of the new Unit would be required to be delivered and assessed.

A candidate in possession of old Unit 'Sub-station Layout and Equipment' could be awarded 25% credit transfer to new Unit 'Switchgear and Protection of High Voltage Systems'. Outcomes 1, 2 and 4 of the new Unit would be required to be delivered and assessed.

HN Unit Credit Transfer Grid

HN Unit: Synchronous Machines

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN44 35 Synchronous Machines	1	Explain the construction and principle of operation of synchronous Machines	D4LF 04 Synchronous Machines	1	Explain the construction and operation of synchronous machines	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit and full credit transfer from old to new is recommended.	100% credit transfer from OLD to NEW Units.
	2	Explain and evaluate the operating characteristics of a synchronous generator		2	Explain the operating characteristics of a synchronous generator	Outcome 2 of the new Unit is very similar to Outcome 2 of the old Unit and full credit transfer from old to new is recommended.	
	3	Explain and evaluate the operating characteristics of a synchronous motor		3	Explain the operating characteristics of a synchronous motor	Outcome 3 of the new Unit is very similar to Outcome 3 of the old Unit and full credit transfer from old to new is recommended.	

HN Unit Credit Transfer Grid

HN Unit: Three Phase Induction Motors

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN45 35 Three Phase Induction Motors	1	Analyse the performance characteristics of three phase induction motors	D4LJ 04 Three Phase Induction Motors	1	Explain the essential characteristics of three phase induction motors		100% credit transfer from OLD to NEW Units.
	2	Analyse three phase induction motor starting methods		2	Describe speed control methods of three phase induction motors		
	3	Analyse three phase induction motor braking methods		3	Describe starting and braking methods of three phase induction motors		
	4	Select a three phase squirrel cage induction motor and ancillary equipment to match a given industrial load		4	Select a motor/drive system to match a given industrial load		

HN Unit Credit Transfer Grid

HN Unit: Three Phase Systems

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN47 34 Three Phase Systems	1	Explain the production and characteristics of a three phase supply	D4LK 04 Three Phase Systems	1	Explain the production of a three phase supply	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit and full credit transfer from old to new is recommended.	100% credit transfer from OLD to NEW Units.
	2	Evaluate the response of balanced star and delta connected loads supplied by symmetrical three phase supplies		2	Evaluate the response of star and delta balanced loads to the application of a symmetrical three phase supply	Outcome 2 of the new Unit is very similar to Outcome 2 of the old Unit and full credit transfer from old to new is recommended.	
	3	Evaluate the response of unbalanced star and delta connected loads supplied by three and four wire symmetrical three phase supplies		3	Evaluate the response of unbalanced loads to the application of symmetrical three and four wire three phase supplies	Outcome 3 of the new Unit is very similar to Outcome 3 of the old Unit and full credit transfer from old to new is recommended.	
	4	Calculate power and describe the measurement of active power in three phase loads		4	Describe the measurement of active power in three phase systems	Outcome 4 of the new Unit is very similar to Outcome 4 of the old Unit and full credit transfer from old to new is recommended.	

HN Unit Credit Transfer Grid

HN Unit: Transformers

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN49 35 Transformers	1	Explain the construction characteristics of transformers	D4KH 04 Power Transformers	1	Explain the construction of transformers	Outcome 1 of the new Unit is similar to Outcome 1 of the old Unit. Full credit transfer from old to new is recommended.	75% credit transfer from OLD to NEW Units.
	2	Analyse the operation of single-phase transformers on load		2	Explain the groupings of three phase transformers	Outcome 2 of the new Unit is covered by material in Outcomes 3 and 4 of the old Unit. Full credit transfer from old to new is recommended.	
	3	Analyse the operation of three-phase transformers		3	Evaluate the performance of transformers on load	Outcome 3 of the new Unit is covered (with the exception of tap changing) by material in Outcomes 1, 2 and 4 of the old Unit. Full credit transfer from old to new is recommended.	
	4	Explain transformer protection		4	Evaluate the operation of transformers in parallel	Outcome 4 of the new Unit is not covered in the old Unit.	

Credit Transfer Recommendations

A candidate in possession of old Unit 'Power Transformers' could be awarded 75% credit transfer to new Unit 'Transformers'. Outcome 4 of the new Unit would be required to be delivered and assessed.

HN Unit Credit Transfer Grid

HN Unit: Utilisation of Electrical Energy in Buildings

New/revised Unit title	New Revised Outcomes		Old Unit Title	Old Unit Outcomes		Matching Comments	Credit Transfer Rec/mend
DN4A 35 Utilisation of Electrical Energy Buildings	1	Specify the requirements and characteristics of elect. space heating systems	D4LS 04 Utilisation of Electrical Energy	1	Specify Electric Heating Systems	Outcome 1 of the new Unit is very similar to Outcome 1 of the old Unit and full credit transfer from old to new is recommended.	100% credit transfer from OLD to NEW Units.
	2	Specify the requirements and characteristics of lighting systems		2	Select Luminaires for interior industrial and commercial lighting	Outcome 2 of the new Unit is very similar to Outcome 2 of the old Unit and full credit transfer from old to new is recommended.	
	3	Specify the requirements and characteristics of vent. & air cond. systems		3	Explain operation and application of standby, emergency and UPS	There is no equivalent for the old Unit Outcome 3 in the New Unit.	
	4			4	Explain operation of vent & air cond. systems	Outcome 4 of the new Unit is very similar to Outcome 4 of the old Unit and full credit transfer from old to new is recommended.	