Arrangements for:

HNC Chemical Engineering

Group Award Code: G91X 15

Validation date: April 2008

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Version: 02 (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.

Version number	Description	Date
02	Revision of Units: DE1K 33 Workplace Communication in English has been revised by H8T2 33 and finishes on 31/07/2016. DN8D 33 Mathematics for Science 1 has been revised by H8XP 33 and DV9V 34 has been revised by H8XR 34. Old units will finish on 31/07/2017.	08/05/15

Contents

1 Introduction

This is the Arrangement Document for the revised HNC Chemical Engineering (G91X 15) which was validated in April 20008. This document includes: background information on the development of the Group Award, its aims, guidance on access, details of the Group Award structure, and guidance on delivery.

The revised award is designed to prepare candidates for work in the chemical industry, in particular oil refining and related processes, or for progression to further study in chemical engineering.

2 Rationale for the revision of the award

2.1 Background to the development

The previous HNC had been in existence since May 1996 and was overdue for revision by the time of SQA's HN modernisation programme. The revised HNC has been developed as a single centre award, reflecting the specialised skills of the centre and the needs of the chemical industry, particularly in central Scotland.

2.2 The current development

The HNC has been designed to ensure that the needs of the modern chemical industry have been met through the revised content and structure. Thus, the content of the revised HNC is more relevant to the needs of the chemicals industry than that which it replaces.

Additionally, in recent years there has also been an increase in the number of international learners joining the programme. These candidates come to Scotland as a standalone group of learners, are generally all from oil producing countries and work in the oil industry in their country. The revised HNC also takes their needs into account.

2.3 Consultation process

The initial phase reviewed the content of existing provision, identified stakeholders to be consulted on the proposed HNC and collated a schedule for the development.

The consultation involved:

- Colleges
- Employers
- Candidates
- Universities

The stakeholders were consulted at key milestones in the development. Their feedback was collated and reviewed by the design team. The majority of consultation was carried out either by face-to-face meetings or phone conversations.

2.4 Summary of consultations

The consultation confirmed that there was a need for the revision of the award. The consultation highlighted the need for new individual Units to be developed and areas of existing Units that should be updated. There was also recognition that theory and practical work needed to be delivered together to benefit candidates' learning.

Another significant conclusion was the requirement for the HNC to cater for two different client groups. This was achieved by careful consideration of the framework for the award.

The design team met regularly during the development phase to ensure the Units covered the required areas avoiding any overlap, that no required content was omitted and that assessment would be consistent across the award.

2.5 Target client groups

The HNC Chemical Engineering is intended for candidates with existing industry experience (eg as a process operator or equivalent) or those undertaking an industry-recognised apprenticeship programme. The HNC is not designed for candidates lacking such experience. The award is intended for two main client groups:

- Apprentices

The HNC supports the development of apprentices from a local multinational chemicals company embarking on careers as process operators. The HNC Chemical Engineering is an integral part of the company's apprentice scheme, facilitating candidates' completion of apprenticeships as rounded potential employees. In conjunction with level 3 SVQs, the HNC provides the relevant vocational skills supported by the appropriate theory and technical knowledge. The majority of apprentices who successfully complete the company's programme gain employment with the company.

- International Learners

In recent years there has been an increase in the number of international learners studying for the HNC Chemical Engineering. These candidates comprise experienced process operators attending college for between six and nine months to gain formal certification. Such candidates have experience on 'plant' but limited knowledge of the supporting theory to progress further in the workplace. By completing the revised HNC Chemical Engineering, these candidates can gain the opportunity to progress.

3 Aims of the award

3.1 General aims of the award

The HNC is designed to provide a progressive, integrated and coherent programme of education which is responsive to the needs of candidates and employers.
The general aims of the HNC Chemical Engineering are to:

1 develop candidates' knowledge and skills such as planning, developing and evaluating in the area of chemical engineering.

2 develop employment skills and enhance candidates' employment prospects by providing them with a wide range of theoretical and practical knowledge in chemical engineering. Candidates will also become familiar with soft skills such as learning to work on their own or in a team environment as well as developing skills in producing oral and written reports and enhancing their communications skills

3 enable progression within the SCQF. Candidates may progress onto further study after the completion of the award, or the award may be part of a modern apprentice programme.

4 develop study and research skills in the area of chemical engineering, the use of which will be demonstrated in the Graded Unit.

5 develop transferable skills including Core Skills across all Units including IT skills, numeracy, mathematics, presentation skills, working in a team, problem solving and an increased awareness of health and safety.

6 provide a flexible route to a qualification by meeting demand from industry for a part-time day release programme. The Unitised structure of the course and intended modes of delivery provide access to this qualification from those in employment through day or block release provision. Discrete Units will also be available for study.

3.2 Specific aims of the award

The specific aims of HNC Chemical Engineering are to:

7 provide the candidate with a deeper underpinning knowledge in chemical engineering in order to progress in a process operator/technician role within the chemical industry. This knowledge will be developed in areas of heat transfer, mass and energy balance, fluid flow, distillation, evaporation and mathematics.

8 prepare candidates for an appropriate level of employment within the chemical, oil and gas industry such as process operator or technician in a refinery.

9 develop a range of vocational skills relating to the use, support and development systems appropriate to employment at operator or technician level. This may include operating distillation equipment, heat exchange equipment, fluid flow equipment and completing technical reports.

10 provide candidates with a range of practical skills to enhance and underpin the theory taught within the award. This includes operating heat exchangers, operating distillation columns, operating fluid flow equipment and boilers.

11 develop options to permit an element of vocational specialisation in a variety of areas such as: process safety engineering, water and steam services, process control and fermentation.

3.3 Employment opportunities

Candidates will either be working in a related industry, have previous relevant work experience or following a modern apprenticeship programme where the HNC is a recognised part of that apprenticeship. This programme has been developed in consultation with industry to ensure an appropriate programme to meet the needs of the sector. Candidates will develop competence to work as process operators or technicians.

4 Access to awards

4.1 Access to the awards

It is intended that admission to the HNC should be as broadly based as possible, but consistent with the selection of candidates who have a reasonable chance of successfully completing the course. Therefore, candidates will either be working in a related industry, have previous relevant work experience or following a modern apprenticeship programme where the HNC is a recognised part of that apprenticeship.

It is recommended that they should also have one of the following academic entry qualifications:

- Two Higher Grades — preferably from maths, physics or chemistry and three Standard Grade 3/Intermediate Two passes
- Successful completion of a relevant access course or an appropriate group of NQ Units
- Equivalent qualification to the above, gained through other awarding bodies, such as GCSE, AS levels, City and Guilds

At the discretion of the presenting centre, applications may be considered from those with a different experiential background, who would benefit from undertaking either the HNC, or Units within the framework (eg adult returners, overseas students with relevant qualifications).

4.2 Work experience

Access for candidates with relevant work experience but without the required academic qualifications will be at the discretion of the presenting centre. Relevant work experience may be evidenced, eg by an SVQ level 3 in an appropriate area.

5 Group Award structure

The 12 credit HNC Chemical Engineering will either be studied on a day-release basis over two years or full-time over a period of six to nine months by international learners. It is possible for a full-time learner to complete the award over one academic year by infilling with day-release programmes. The structure and Units chosen reflect the needs of the chemical industry and the needs of the target groups identified earlier, ensuring that candidates will have a set of knowledge and skills that complement and build upon their existing industry knowledge and skills.

5.1 Framework

To attain the HNC Chemical Engineering, candidates must achieve all mandatory Units totalling 9 credits and optional Units worth 3 credits.

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
Industrial Chemicals: Processes and Products	F3XD 34	8	7	1
Process Operations: Distillation	F3XF 35	8	8	1
Chemical Engineering Principles	F3X8 34	8	7	1
Mathematics for Science 1	H8XP 33*	8	6	1
Process Operations: Heat Exchange, Drying and Evaporation	F3XG 35	8	8	1
Fluid Mechanics: Theory and Practice	F3XB 34	8	7	1
Heat Transfer: Theory and Practice	F3XC 34	8	7	1
Chemical Engineering: Applied Physical Chemistry	F3X9 34	8	7	1
Chemical Engineering: Graded Unit 1	F4CG 34	8	7	1

Optional Units — 1 to 3 credits

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
Mathematics for Science 2	H8XR 34*	8	7	1
Process Safety Engineering	F43J 34	8	7	1
Information Technology: Applications Software 1	D75X 34	8	7	1
Fundamental Chemistry: Theory and Practice	DH2K 34	16	7	1
Process Control	DX4K 34	8	7	1
Fermentation Engineering	F3XA 34	8	7	1
Process Water and Steam Services	F3XH 34	8	7	1

Broadening Units — 0 to 2 credits

Unit title	Code	SCQF credit points	SCQF level	SQA credit value
Workplace Communication in English	H8T2 33*	8	6	1
Personal Development Planning	DE3R 34	8	7	1
ESOL for Work: Advanced Operational	F1HW 34	8	7	1

*Refer to History of Changes Table

5.2 Graded Unit information

The purpose of the Graded Unit is to assess the candidate's ability to integrate and apply the Knowledge and/or Skills gained in individual Units, to demonstrate that they have achieved the specific aims of the award as detailed in Section 3.2, and to grade candidate achievement.

Candidates will take a single credit Graded Unit at SCQF level 7 in the HNC Chemical Engineering.

5.3 Type of Graded Unit

Chemical Engineering: Investigation report

This Unit will be a project in the form of an investigation, which should ideally take place during the last block of study. It will cover a range of skills achieved through studying the mandatory Units of the award.

5.4 Rationale for Graded Unit assessment

Investigation report

Candidates will select an appropriate topic to research, subject to approval by the course lecturer. The candidate will produce a report covering the planning, developing and evaluation stages of the investigation. An investigation report allows candidates to integrate knowledge and skills gained in the mandatory Units. It allows them to use research skills, set timescales, and identify main issues, methods and sources of research. It also allows them to use written scientific report writing skills in setting out the aims, data, analysis, summary, evaluation and references relevant to their investigation.

5.5 Core Skills exit level

The importance of Core Skills has been recognised and these are developed throughout the award. In addition, Core Skills may feature in the entry qualifications that candidates have already achieved, eg *Problem Solving* at SCQF level 5 is embedded in all science Highers. It should be noted that although there are no mandatory entry and exit levels the following are recommended:

Core Skill	Desired Entry level	Anticipated Exit level
Communication	5	Signposted at SCQF level 6
Numeracy	5	Signposted at SCQF level 6
IT	5	Signposted at SCQF level 6
Problem Solving	5	Signposted at SCQF level 6
Working with Others	4	Signposted at SCQF level 5

There are opportunities within the HNC to gather evidence towards Core Skills or Core Skills components (see Appendix 1). However, the only automatic Core Skill certification is on successful completion of the optional Unit, *Information Technology: Applications Software 1*. This gives certification of *Information Technology* at SCQF level 6

5.6 Mapping information

The relationship of aims to Units are described in section 3 Aims of the Award, with a table illustrating this also contained in Appendix 2.

5.7 Articulation and credit transfer

5.7.1 Progression to HND

Although there is no Chemical Engineering HND, there is possible progression to the HND Chemical Process Technology.

5.7.2 Progression to higher education

Candidates achieving the existing HNC Chemical Engineering have progressed to Paisley University's Chemical Engineering programme (now The University of the West of Scotland), or to Strathclyde University's distance learning chemical engineering programme. It is anticipated that similar agreements will be established for the new award.

5.7.3 Transition arrangements

It is possible that a candidate on the existing HNC Chemical Engineering framework may be unable to complete the award, due to an enforced break in their studies and may wish to resume with the revised programme. In such cases, credit transfer can assist with the transfer of such candidates to the revised programme.

The proposed credit transfer arrangements are shown in Appendix 3, on a Unit by Unit basis.

6 Approaches to delivery and assessment

6.1 Content and context

The HNC Chemical Engineering is a specialised award which enables candidates to acquire knowledge and technical skills in heat transfer, fluid mechanics, process operations and industrial chemistry. The options allow candidates to choose areas of specialism that may be related to current or future employment including fermentation, water and steam services and process control.

The structure of the award is supported by employers as meeting their requirements.

6.2 Sequencing of Units

Although centres can choose the order in which to teach Units within the award, guidelines have been produced on the timetabling of mandatory Units (Appendix 4). These timetables reflect the 'building block' nature of the Units and the two client groups expected to undertake the programme.

It is envisaged that a mixture of delivery methods will be utilised in the delivery of the programme. These will include course booklets, presentations, practical work, group work and the VLE.

The assessment strategy of the design principles to encourage a more holistic approach to assessment has been adopted in the award. The new HN Unit specification places the emphasis on reducing the assessment load for candidates and centres by devising assessments which encompass the entire theoretical content of the Unit (where appropriate), and/or by sampling of knowledge and skills.

6.3 Practical laboratory hours

The laboratory hours given below are for information only. Some Units have no mandatory laboratory work, though elements of the theory can be taught using practical experiments.

Mandatory Units — total of 9 credits

Unit title	Code	SCQF credit points	SCQF level	Laboratory hours
Chemical Engineering Principles	F3X8 34	8	7	10
Chemical Engineering: Applied Physical Chemistry	F3X9 34	8	7	10
Mathematics for Science 1	H8XP 33*	8	6	0
Chemical Engineering: Graded Unit 1	F4CG 34	8	7	0
Process Operations: Heat Exchange, Drying and Evaporation	F3XG 35	8	8	0
Fluid Mechanics: Theory and Practice	F3XB 34	8	7	5
Industrial Chemicals: Processes and Products	F3XD 34	8	7	0
Process Operations: Distillation	F3XF 35	8	8	15
Heat Transfer: Theory and Practice	F3XC 34	8	7	15

Optional Units — maximum 3 credits

Unit title	Code	SCQF credit points	SCQF level	Laboratory hours
Fundamental Chemistry: Theory and Practice	DH2K 34	16	7	30
Information Technology: Applications Software 1	D75X 34	8	7	0
Process Safety Engineering	F43J 34	8	7	0
Mathematics for Science 2	H8XR 34*	8	7	0
Fermentation Engineering	F3XA 34	8	7	0
Process Water and Steam Services	F3XH 34	8	7	10
Process Control	DX4K 34	8	7	10

Optional Broadening Units — maximum 2 credits

Unit title	Code	SCQF credit points	SCQF level	Laboratory hours
Workplace Communication in English	H8T2 33*	8	6	0
ESOL for Work: Advanced Operational	F1HW 34	8	7	0
Personal Development Planning	DE3R 34	8	7	0

*Refer to History of Changes Table

6.4 Guidance on Open Learning

The revised HNC Chemical Engineering could be delivered by open learning, though not wholly so, as some Units require specialist practical facilities which preclude this. Candidates would need to attend the presenting centre or other agreed institution to complete the practical assessments in these cases. Centre-devised supervision agreements should detail controlled conditions to ensure authenticity of evidence.

Full details on the suitability of individual Units for Open Learning are contained in each individual Unit specification. Aspects of many Units could be delivered on an Open Learning basis, but arrangements would be required to ensure that any assessments were the candidate's own work.

7 General information for centres

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

Internal and external verification

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

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

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

8 General information for candidates

The HNC Chemical Engineering is suitable for you if you have previous experience in the chemical industry or are following a related modern apprenticeship. The HNC builds on existing knowledge and/or exposure to the systems and processes used in the chemical industry, and further develops knowledge and skills in chemical engineering.

The award develops employment skills and enhances employment prospects by providing a wide range of theoretical and practical knowledge in chemical engineering. It also develops 'soft' skills such as working in a team environment, producing reports and will enhance communication skills.

The delivering centre should provide you with information about the HNC Chemical Engineering before you commence your studies, in the form of a course handbook or equivalent. The information will give details of the knowledge and skills you will develop during the course and how you will be assessed.

You will also gain knowledge in the subject areas related to chemical engineering. These include:

- Mass and energy balance
- Heat transfer
- Fluid mechanics
- Process operations

Along with the development of chemical engineering knowledge, you may develop other skills, including:

- Study and research skills
- Employment skills
- Planning, developing and evaluating skills
- The Core Skills of *Numeracy, IT, Problem Solving, Communication* and *Working with Others*

In order to pass each individual Unit you will need to evidence understanding of the topic studied, and where practical elements are taught you will have to complete practical experiments and produce a laboratory report or pro forma based report. Throughout your studies you will be expected to demonstrate safe working practices.

Along with the assessments for all Units, you will also be required to complete a Graded Unit. The Graded Unit will be in the form of an investigation. The investigation will be on a topic of interest to you that is related to the course. If you are in employment while studying for the HNC, you may choose a related topic from the workplace. The overall purpose of the Graded Unit is to allow you to integrate the knowledge and skills you have developed throughout the award, in a piece of work. On completion of the Graded Unit you will be awarded either an A, B or C grade if you pass the Unit.

9 Glossary of terms

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

SCQF credit points: One HN credit is equivalent to 8 SCQF credit points. This applies to all HN Units, irrespective of their level.

SCQF levels: The SCQF covers 12 levels of learning. HN Units will normally be at levels 6–9. Graded Units will be at level 7 and 8.

Subject Unit: Subject Units contain vocational/subject content and are designed to test a specific set of knowledge and skills.

Graded Unit: Graded Units assess candidates' ability to integrate what they have learned while working towards the Units of the Group Award. Their purpose is to add value to the Group Award, making it more than the sum of its parts, and to encourage candidates to retain and adapt their skills and knowledge.

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

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

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

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

Consortium-devised HNCs and HNDs are those developments or revisions undertaken by a group of centres in partnership with SQA.

Specialist single centre and specialist collaborative devised HNCs and HNDs are those developments or revisions led by a single centre or small group of centres who provide knowledge and skills in a specialist area. Like consortium-devised HNCs and HNDs, these developments or revisions will also be supported by SQA.

10 Appendices

Appendix 1: Core Skills mapping of HNC Chemical Engineering
Appendix 2: Mapping of HNC Chemical Engineering aims to Units
Appendix 3: Transition arrangements
Appendix 4: Suggested delivery schedule

Appendix 1: Core Skills mapping of HNC Chemical Engineering

Unit	Core Skills				
	Numeracy	**Communication**	**Information Technology**	**Problem Solving**	**Working with Others**
Industrial Chemicals: Processes and Products		✓ Higher	✓ Higher		
Process Operations: Distillation	✓ Higher	✓ Higher		✓ Higher	✓ Intermediate 2
Chemical Engineering Principles	✓ Higher			✓ Higher	
Mathematics for Science 1	✓ Higher			✓ Higher	
Fundamental Chemistry: Theory and Practice	✓ Higher	✓ Higher		✓ Higher	
Process Operations: Heat Exchange, Drying and Evaporation	✓ Higher	✓ Higher	✓ Higher	✓ Higher	
Fluid Mechanics: Theory and Practice	✓ Higher	✓ Higher	✓ Higher	✓ Higher	✓ Intermediate 2
Heat Transfer: Theory and Practice	✓ Higher	✓ Higher	✓ Higher	✓ Higher	✓ Intermediate 2
Chemical Engineering: Applied Physical Chemistry	✓ Higher			✓ Higher	
Mathematics for Science 2	✓ Higher				
Process Safety Engineering	✓ Higher	✓ Higher		✓ Higher	
Information Technology: Applications Software 1			✓Embedded Higher		
Process Control				✓ Higher	
HNC Graded Unit		✓ Higher	✓ Higher	✓ Higher	
Fermentation Engineering	✓ Higher			✓ Higher	
Process Water and Steam Services	✓ Higher	✓ Higher		✓ Higher	
ESOL for Work: Advanced Operational		✓ Higher			

Communication (Higher)

Skill component: Written Communication (Reading)

Read and Understand complex written communication

a Identify and summarise all significant information, ideas and supporting details in a complex written environment.
b Evaluate fully the effectiveness of a communication in meeting its purpose and needs of its intended readership.

Unit	Knowledge and Skills/ Evidence	Developed/Assessed	a	b
Industrial Chemicals: Processes and Products	Outcome 3	Developed	√	√
Fundamental Chemistry: Theory and Practice	Outcome 2	Developed	√	√
Process Safety Engineering	Outcome 4	Developed	√	√
Process Operations: Distillation	Outcome 2	Developed	√	√
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√	√
Heat Transfer: Theory and Practice	Outcome 2	Developed	√	√
ESOL for Work: Advanced Operational	Outcome 3	Developed	√	√
Process Water and Steam Services	Outcome 3	Developed	√	√

Written Communication (Writing)

Produce well-structured Written Communication on complex topics

a Present all essential ideas/information and supporting detail in a logical and effective order.
b Use a structure which takes account of purpose and audience and links major and minor points in ways which assist the clarity and impact of the writing.
c Use conventions which are effective in achieving the purpose and adapted as necessary for the target audience.
d Use spelling, punctuation and sentence structures which are consistently accurate.
e Vary sentence structure, paragraphing and vocabulary to suit the purpose and target audience.

Unit	**Knowledge and Skills/Evidence**	**Developed/Assessed**	**a**	**b**	**c**	**d**	**e**
Industrial Chemicals: Processes and Products	Outcome 3	Developed	√	√	√	√	√
Fundamental Chemistry: Theory and Practice	Outcome 2	Developed	√	√	√	√	√
Process Safety Engineering	Outcome 4	Developed	√	√	√	√	√
Process Operations: Distillation	Outcome 2	Developed	√	√	√	√	√
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√	√	√	√	√
Heat Transfer: Theory and Practice	Outcome 2	Developed	√	√	√	√	√
Process Water and Steam Services	Outcome 2	Developed	√	√	√	√	√
ESOL for Work: Advanced Operational	Outcomes 3 and 4	Developed	√	√	√	√	√

Oral Communication

Produce and respond to oral Communication on a complex topic

a Use vocabulary and a range of spoken language structures consistently and effectively at an appropriate level of formality.
b Convey all essential information, opinions or ideas with supporting detail accurately and coherently and with varied emphasis as appropriate.
c Structure communication to take full account of purpose and audience.
d Take account of situation and audience during delivery.
e Respond to others, taking account of their contributions.

Unit	**Knowledge and Skills/Evidence**	**Developed/Assessed**	**a**	**b**	**c**	**d**	**e**
Process Operations: Heat Exchange, Drying and Evaporation	Outcome 2	Assessed	√	√	√	√	√

Using Information Technology (Higher)

Use an IT system independently to process a range of information

a Use a range of IT equipment paying attention to security and other users.
b Resolve one simple hardware or software problem.
c Use software in an unfamiliar context requiring some analysis and design, integration of data decision on output format.
d Carry out two searches to extract and present information from electronic data sources.

Unit	**Knowledge and Skills/Evidence**	**Developed/Assessed**	**a**	**b**	**c**	**d**
Information Technology: Applications Software 1	Embedded in Unit	Assessed	√	√	√	√
Process Operations: Heat Exchange, Drying and Evaporation	Outcome 2	Developed	√		√	√
Process Safety Engineering	Outcome 4	Developed	√		√	
Heat Transfer: Theory and Practice	Outcome 2	Developed	√		√	
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√		√	
Industrial Chemicals: Processes and Products	Outcome 3	Developed	√		√	√
Graded Unit 1		Developed	√		√	√

Numeracy (Higher)

Skill component: Using Number

Apply a wide range of numerical skills

a Work confidently with a numerical or statistical concept.
b Decide on the steps and operations to be carried out.
c Carry out a number of sustained, complex calculations.

Unit	Knowledge and Skills/Evidence	Developed/Assessed	a	b	c
Process Operations: Distillation	Outcomes 1 and 2	Developed	√	√	√
Chemical Engineering Principles	Outcomes 1 and 2	Developed	√	√	√
Mathematics for Science 1	Outcomes 1 and 2	Developed	√	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Process Operations: Heat Exchange, Drying and Evaporation	Outcomes 1, 2 and 3	Developed	√	√	√
Fluid Mechanics: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Heat Transfer: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Chemical Engineering: Applied Physical Chemistry	Outcomes 1 and 2	Developed	√	√	√
Mathematics for Science 2	Outcomes 1 and 2	Developed	√	√	√
Process Water and Steam Services	Outcome 3	Developed	√	√	√
Fermentation Engineering	Outcome 2	Developed	√	√	√
Process Safety Engineering	Outcome 3	Developed	√	√	√

Numeracy (Higher)

Skill component: Using Graphical Information

Interpret and communicate graphical information in everyday and generalised contexts

a Analyse and interpret complex graphical information.
b Select an appropriate form of table, graph, chart, diagram or qualitative form and communicate information in that form.

Unit	Knowledge and Skills/Evidence	Developed/Assessed	a	b
Process Operations: Distillation	Outcomes 1 and 2	Developed	√	√
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√
Process Operations: Heat Exchange, Drying and Evaporation	Outcome 3	Developed	√	√
Chemical Engineering Principles	Outcome 2	Developed	√	√
Process Operations: Distillation	Outcomes 1 and 2	Developed	√	√

Problem Solving (Higher)

Skill component: Critical Thinking

Analyse a complex situation or issue

a Identify the factors involved in the situation or issue.
b Assess the relevance of these factors to the situation or issue.
c Develop and justify an approach to deal with the situation or issue.

Unit	Knowledge and Skills/Evidence	Developed/Assessed	a	b	c
Fundamental Chemistry: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Process Operations: Distillation	Outcomes 1 and 2	Developed	√	√	√
Fluid Mechanics: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Heat Transfer: Theory and Practice	Outcomes 1 and 2	Developed	√	√	√
Chemical Engineering: Applied Physical Chemistry	Outcomes 1, 2 and 3	Developed	√	√	√
Process Safety Engineering	Outcomes 1 and 2	Developed	√	√	√
Industrial Chemicals: Processes and Products	Outcome 3	Developed	√	√	√
Fundamental Chemistry: An Introduction	Outcomes 1 and 2	Developed	√	√	√
Process Safety Engineering	Outcomes 1,2,3 and 4	Developed	√	√	√
Fermentation Engineering	Outcomes 1 and 2	Developed	√	√	√
Process Water and Steam Services	Outcomes 1, 2 and 3	Developed	√	√	√

Problem Solving (Higher)

Skill component: Planning and Organising

Plan, organise and complete a very simple, familiar task

a Identify some very simple steps in the plan.
b Select appropriate resources to carry out the plan.
c Carry out the task.

Unit	Knowledge and Skills/Evidence	Developed/Assessed	a	b	c
Process Operations: Distillation	Outcome 2	Developed	√	√	√
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√	√	√
Heat Transfer: Theory and Practice	Outcome 2	Developed	√	√	√
Fundamental Chemistry: Theory and Practice	Outcome 2	Developed	√	√	√
Process Water and Steam Services	Outcome 3	Developed	√	√	√

Problem Solving (Higher)

Skill components: Reviewing and Evaluating

Review and evaluate a complex problem solving activity

a Evaluate the effectiveness of the strategy/strategies.
b Identify and gather appropriate evidence.
c Draw conclusions and make recommendations.

Unit	Knowledge and Skills/ Evidence	Developed/ Assessed	a	b	c
Process Operations: Distillation	Outcome 2	Developed	√	√	√
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√	√	√
Heat Transfer: Theory and Practice	Outcome 2	Developed	√	√	√
Fundamental Chemistry: Theory and Practice	Outcome 2	Developed	√	√	√
Process Water and Steam Services	Outcome 3	Developed	√	√	√

Working with Others (Intermediate 2)

Work with Others in a group to analyse, plan and complete an activity

a Analyse the activity and identify the component tasks and roles which make up the activity.
b Agree allocation of responsibilities taking account of own strengths and weaknesses and those of others.
c Support co-operative working.
d Evaluate and draw a conclusion about own contribution to group activity, and justify this by referring to supporting evidence.

Unit	**Knowledge and Skills/Evidence**	**Developed/Assessed**	**a**	**b**	**c**	**d**
Process Operations: Heat Exchange, Drying and Evaporation	Outcome 2	Developed	√	√	√	
Process Operations: Distillation	Outcome 2	Developed	√	√	√	
Fluid Mechanics: Theory and Practice	Outcome 2	Developed	√	√	√	
Heat Transfer: Theory and Practice	Outcome 2	Developed	√	√	√	

Appendix 2: Mapping of HNC Chemical Engineering aims to Units

Unit code	Unit title	Aim 1	Aim 2	Aim 3	Aim 4	Aim 5	Aim 6	Aim 7	Aim 8	Aim 9	Aim 10	Aim 11
F3XD 34	Industrial Chemicals: Processes and Products	✓	✓	✓		✓	✓	✓	✓	✓	✓	
F3XK 35	Process Operations: Distillation	✓	✓	✓		✓	✓	✓	✓	✓	✓	
F3X8 34	Chemical Engineering Principles	✓	✓	✓		✓	✓	✓	✓		✓	
DN8D 33	Maths for Science 1		✓	✓		✓	✓	✓	✓		✓	
F3XG 35	Process Operations: Heat Exchange, Drying and Evaporation	✓	✓	✓		✓	✓	✓	✓	✓	✓	
F3XB 34	Fluid Mechanics: Theory and Practice	✓	✓	✓		✓	✓	✓	✓	✓	✓	
F3XC 34	Heat Transfer: Theory and Practice	✓	✓	✓		✓	✓	✓	✓	✓	✓	
F3X9 34	Chemical Engineering: Applied Physical Chemistry		✓	✓		✓	✓	✓	✓		✓	
F4CG 34	Chemical Engineering: Graded Unit 1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	

Appendix 3: Transition arrangements

Predecessor Unit		Revised Unit		Credit transfer conditions
Unit code	**Unit title**	**Unit code**	**Unit title**	
A70S 04	Industrial Chemicals: Processes and Products	F3XD 34	Industrial Chemicals: Processes and Products	Full
A710 04	Diffusional Process	F3XF 35	Process Operations: Distillation	Partial: credit transfer given for Outcome 1 in the revised Unit
A6BG 04	Chemical Engineering Principles	F3X8 34	Chemical Engineering Principles	Full
A70Y 04	Chemical Engineering: Mass and Heat Transfer Processes	F3XG3 5	Process Operations: Heat Exchange, Drying and Evaporation	Full
A70R 04	Chemical Engineering: Fluid Mechanics	F3XB 34	Fluid Mechanics: Theory and Practice	Partial: credit transfer given for Outcomes 1 and 2
A6BH 04	Chemical Engineering: Heat and Mass Transfer	F3XC 34	Heat Transfer: Theory & Practice	Partial: credit transfer given for Outcome 1
A70V 04	Chemical Engineering: Applied Physical Chemistry	F3X9 34	Chemical Engineering: Applied Physical Chemistry	Full
		DV9V 34	Mathematics for Science 2	Not applicable
D5NB 04	Safety Engineering	F43J 34	Process Safety Engineering	Partial: credit transfer given for Outcomes 1, 2 and 4
A715 04	Chemical Engineering Laboratory	F3XB 34	Fluid Mechanics: Theory and Practice	Partial: credit transfer given for Outcome 3
		F3XC 34	Heat Transfer: Theory & Practice	Partial: credit transfer given for Outcome 2
		F3XF 34	Process Operations: Distillation	Partial: credit transfer given for Outcome 2
	Mathematics 1 for Chemical Processes	DN8D 33	Mathematics for Science 1	Partial: credit transfer given for Outcomes 1, 2 and 3

Appendix 4: Suggested delivery schedule

Mode of Study: Day release over two years, *(examples of suggested options in brackets)*

Unit code	Unit title	Level	Mandatory (M)/ Optional(O)	Credit value	Block 1 year 1	Block 2 Year 1	Block 1 Year 2	Block 2 Year 2
F3X8 34	Chemical Engineering Principles	7	M	1	✓			
DN8D 33	Mathematics for Science 1	7	M	1	✓			
F3XC 34	Heat Transfer: Theory and Practice	7	M	1	✓			
F3XB 34	Fluid Mechanics: Theory and Practice	7	M	1		✓		
F3XD 34	Industrial Chemicals: Processes and Products	7	M	1		✓		
	Option 1*(eg Process Safety Engineering)*	7	O	1		✓		
	Option 2 *(eg Mathematics for Science 2)*	7	O	1			✓	
F3X9 34	Chemical Engineering: Applied Physical Chemistry	7	M	1			✓	
F3XG 35	Process Operations: Heat Exchange, Drying and Evaporation	8	M	1			✓	
F4CG 34	Graded Unit	7	M	1				✓
	Option 3 *(eg Process Water and Steam Services)*	7	O	1				✓
F3XK 35	Process Operations: Distillation	7	M	1				✓

Mode of Study: Full-time, international learners *(examples of suggested options in brackets)*

Unit code	Unit title	Level	Mandatory (M)/ Optional(O)	Credit value	Block 1	Block 2
F3X8 34	Chemical Engineering Principles	7	M	1	✓	
DN8D 33	Mathematics for Science 1	7	M	1	✓	
F3XC 34	Heat Transfer: Theory and Practice	7	M	1	✓	
F3XB 34	Fluid Mechanics: Theory and Practice	7	M	1		✓
F3XD 34	Industrial Chemicals: Processes and Products	7	M	1	✓	
	Option 1 *(eg It apps 1)*	7	O	1	✓	
	Option 2 *(eg ESOL)*	7	O	1	✓	
F3X9 34	Chemical Engineering: Applied Physical Chemistry	7	M	1		✓
F3XG 35	Process Operations: Heat Exchange, Drying and Evaporation	8	M	1		✓
F4CG 34	Graded Unit	7	M	1		✓
	Option 3 (eg *Process Safety Engineering)*	7	O	1		✓
F3XK 35	Process Operations: Distillation	7	M	1		✓