

Next Generation Higher National Unit Specification

Professional Practice in Engineering (SCQF level 7)

Unit code: J6CS 47
SCQF level: 7 (32 SCQF credit points)
Valid from: session 2024 to 2025

Prototype unit specification for use in pilot delivery only (version 2.0) March 2024

This unit specification provides detailed information about the unit to ensure consistent and transparent assessment year on year.

This unit specification is for teachers and lecturers and contains all the mandatory information required to deliver and assess the unit.

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Unit purpose

This unit provides an opportunity for learners to develop and apply their knowledge and skills in engineering to a realistic problem. An important aim of this unit is to improve professional practice and behaviours through the development of meta-skills.

It forms part of the Higher National Certificate (HNC) in Engineering, which is for learners who want to become engineering technicians. The target group for this unit are those studying a qualification that develops core engineering design and analysis skills to support a career in engineering.

In this project-based unit, learners to work together as a small project team to design or develop, and evaluate, solutions to a real-world engineering problem.

Entry is at your discretion. However, we recommend that learners have one or more of the following:

- ◆ a broad knowledge and understanding of engineering processes and theorems at SCQF level 6, for example units related to electrical engineering, electronics and mechanical principles
- ◆ an appreciation of manufacturing principles and project and risk management at SCQF level 6, for example in subjects related to manufacturing principles, and project and risk management
- ◆ relevant, equivalent workplace experience or SCQF level 6 qualifications, for example Higher Physics or a National Certificate (NC) in Engineering Systems

At SCQF level 7, this unit provides learners with suitable knowledge and skills for progression or articulation to further study or employment in a wide range of engineering industries.

Unit outcomes

Learners who complete this unit can:

- 1 use engineering and digital skills to solve a real-world engineering problem
- 2 demonstrate team working skills
- 3 use project management concepts
- 4 use communication skills to communicate progress and solutions
- 5 develop own meta-skills in a vocational context

Evidence requirements

You can assess all outcomes holistically using written and/or oral recorded evidence. Learners generate evidence under unsupervised, open-book conditions and produce a portfolio.

To successfully achieve the unit, learners must provide evidence that they have completed the following outcomes:

Outcome 1

Introduction to the real-world problem, with individual evidence showing that learners have:

- ◆ explained the problem
- ◆ investigated solutions
- ◆ evaluated two solutions to the problem
- ◆ summarised the ethical considerations of the solutions to the problem
- ◆ examined and summarised the sustainability and environmental impacts of the solutions to the problem
- ◆ examined and explained the importance of the solutions' safety, quality and reliability
- ◆ in collaboration with the team, chosen and justified a single viable solution

Outcome 2

Collective evidence of team working, showing learners have contributed to:

- ◆ negotiating the team's solution process
- ◆ negotiating task responsibilities within the team, taking account of resources and individual members' strengths and weaknesses
- ◆ dated minutes of eight team meetings where contributions were made

Provide evidence that learners have:

- ◆ led an aspect of team working
- ◆ produced eight sequentially dated team-evaluation reports

Outcome 3

Use project management concepts, with collective evidence showing that learners have contributed to:

- ◆ identifying individual sub-tasks using a work breakdown structure
- ◆ a summary of equality, diversity and inclusion considerations in project management
- ◆ action definition and progress tracking

Provide evidence that learners have:

- ◆ produced, and twice edited, a project plan
- ◆ produced, and twice edited, a risk register

Outcome 4

Use communication skills to communicate progress and solutions, with collective evidence showing that learners have contributed to:

- ◆ orally (or equivalent) presenting progress and solutions

Provide evidence that learners have:

- ◆ produced eight sequentially dated logbook entries
- ◆ produced a professional and accurate technical report

Outcome 5

Provide evidence that learners have:

- ◆ carried out a self-assessment of their own meta-skills baseline
- ◆ created a plan for their own meta-skills development
- ◆ carried out activities to develop and demonstrate meta-skills
- ◆ used reflective practice to monitor and assess the meta-skills they have improved or developed

Meta-skills

In [Skills 4.0: a skills model to drive Scotland's future](#), Centre for Work-based Learning in Scotland, the three categories of self-management, social intelligence and innovation are outlined, each with four meta-skills and a number of sub-skills. We do not expect learners to develop or reference all of these and none are in themselves mandatory.

There are many interrelationships and dependencies between these skills and, at SCQF level 7, the focus should be on holistic development within a vocational context.

Learners should reflect in depth on the meta-skills they are developing and the relationships between them, and include references to course projects, outputs and experiences that contribute to that development. It is the depth of reflection that is important, not the number of meta-skills referenced. You can find more information in the Educator Guide.

Knowledge and skills

The following table shows the knowledge and skills covered by the unit outcomes.

Knowledge	Skills
<p>Outcome 1 Learners should understand how to use engineering and digital skills to solve a real-world engineering problem by:</p> <ul style="list-style-type: none"> ◆ explaining the problem ◆ investigating solutions to the problem ◆ evaluating solutions to the problem ◆ examining and summarising the sustainability and environmental impacts of solutions to the problem in the context of the United Nations Sustainable Development Goals (SDGs) ◆ explaining how one product or process relevant to the project can be made more sustainable and help meet the aims of at least two selected SDGs ◆ examining and explaining the importance of the solutions' safety, quality and reliability ◆ in collaboration with the team, choosing and justifying a single viable solution to the problem 	<p>Outcome 2 Learners can demonstrate team working skills by:</p> <ul style="list-style-type: none"> ◆ negotiating and agreeing the team's solution process ◆ negotiating and agreeing task responsibilities within the team, taking account of resources and individual members' strengths and weaknesses ◆ contributing to team meetings ◆ leading some aspects of team working ◆ producing regular team-evaluation reports
	<p>Outcome 3 Learners can use project management concepts by:</p> <ul style="list-style-type: none"> ◆ identifying individual sub-tasks using a work breakdown structure ◆ summarising equality, diversity and inclusion considerations in project management ◆ producing and maintaining a project plan ◆ producing and maintaining a risk register ◆ defining actions and tracking progress

Knowledge	Skills
	<p>Outcome 4</p> <p>Learners can use communication skills to communicate progress and solutions by:</p> <ul style="list-style-type: none"> ◆ producing and regularly maintaining a logbook ◆ orally (or equivalent) presenting progress and solutions ◆ producing a professional, final technical report
<p>Outcome 5</p> <p>Learners should understand:</p> <ul style="list-style-type: none"> ◆ the categories of self-management, social intelligence and innovation, and associated meta-skills, as described in Skills 4.0: a skills model to drive Scotland's future, Centre for Work-based Learning in Scotland ◆ the importance of developing meta-skills for employability, adaptability and effectiveness ◆ the specific meta-skills most relevant to a vocational context, from categories of self-management, social intelligence and innovation ◆ self-awareness: analysing preferences, strengths and weaknesses; meta-skills self-assessment ◆ goal setting and action planning ◆ reflective practice: principles of reflective practice; tools and approaches for effective reflective practice 	<p>Outcome 5</p> <p>Learners can develop their meta-skills in a vocational context by:</p> <ul style="list-style-type: none"> ◆ planning a strategy for meta-skills development ◆ implementing and reviewing plans for meta-skills development ◆ assessing their own meta-skills development

Meta-skills

Throughout the unit, learners develop meta-skills to enhance their employability in the engineering sector.

The HNC in Engineering uses a holistic teaching and assessment approach in keeping with the interconnected nature of engineering sectors. Learners naturally develop meta-skills by engaging with the content of the qualification.

Self-management

Learners develop their focusing skills as they work to a project plan. They also develop adaptability, through team working compromises, and take initiative with their responsibility in ensuring successful team outcomes.

Social intelligence

Learners develop empathy with their team members and social conscience in ensuring solutions are ethical and sustainable. They build relationships while team working, and influence and inspire their team co-workers while leading team sessions.

Innovation

Learners develop problem recognition when they explain the problem and generate ideas. They develop holistic and logical thinking when making sense of the problem and critically thinking of solutions.

Literacies

Learners develop core skills in the following literacies:

Numeracy

Learners develop numeracy skills by performing engineering and timescale calculations.

Communication

Learners develop their communications skills by working in a team and presenting results.

Digital

Learners develop their digital literacy by using research methods. They use software for project management, engineering applications and preparing results for presentation.

Delivery of unit

This unit is part of the HNC in Engineering. The framework includes mandatory and optional units, and you can tailor the selected combination of units to specific engineering pathway needs.

The notional design length is 160 hours, however, the exact time you allocate to this unit is at your discretion. As there is considerable integration of outcomes, we suggest the following distribution of time, including assessment:

Outcome 1 — Use engineering and digital skills to solve a real-world engineering problem
(50 hours)

Outcome 2 — Demonstrate team working skills
(20 hours)

Outcome 3 — Use project management concepts
(30 hours)

Outcome 4 — Use communication skills to communicate progress and solutions
(30 hours)

Outcome 5 — Develop own meta-skills in a vocational context
(30 hours)

Additional guidance

The guidance in this section is not mandatory.

Content and context for this unit

This unit gives learners some of the knowledge and skills they need to support a career in engineering such as:

- ◆ electrical engineering
- ◆ mechanical engineering
- ◆ systems engineering
- ◆ manufacturing engineering
- ◆ measurement and control engineering

The unit uses a project-based, team working approach to develop professional skills and meta-skills, which are in high demand for engineering careers.

Approaches to delivery

We recommend you use a non-sequential approach to delivering the outcomes. The project plan produced for outcome 3 determines the order of activities and provides evidence for outcomes 1, 3 and 4. You should collect evidence for outcomes 2 and 5 throughout the delivery of the unit.

For team working, we recommend team sizes of between two and four learners. You can place them in teams randomly, or based on Belbin's Team Roles Theory, or leave them to decide themselves. If there is only one learner, a member of staff can role play so you can assess the learner's team working skills.

Monitor progress regularly, and provide additional help if necessary. You should re-assign teams if they are not working well together.

Provide learners with support, guidance and feedback on areas of development, and signpost developmental opportunities.

Approaches to assessment

As this unit assesses technical skills and meta-skills equally, it is important that learners demonstrate both; in particular, their contribution to team tasks should be of appropriate depth and breadth. As a guide:

- ◆ the problem solution should be technical and viable, costs and/or implementation timescales should not prohibit innovation
- ◆ each team member should lead at least one activity, such as chairing a meeting, co-ordinating a presentation, action chasing, or leading an idea-generating session

- ◆ evidence of reports and logs should be as specified in the 'Evidence requirements' section, but equivalents are acceptable to meet the needs of individual learners, for example oral, photographic, illustrations or computer generated
- ◆ professional skills can include abilities in:
 - application of technical knowledge
 - research
 - problem analysis
 - problem solving
 - solution or process design
 - critical reflection
 - systematic planning and monitoring
 - project management
 - informed decision making
- ◆ meta-skills can include abilities in:
 - focusing
 - integrity
 - adapting
 - initiative
 - communicating
 - feeling
 - collaborating
 - leading
 - curiosity
 - creativity
 - sense-making
 - critical thinking
- ◆ digital technologies can include:
 - big data and data analysis
 - artificial intelligence
 - scanning technologies
 - internet of things
 - robotics
 - immersive technologies
 - digital twins

- ◆ digital skills can include use of:
 - application specific software
 - mathematical software
 - analysis or modelling software
 - efficient word processing
 - databases
 - cloud computing
 - simulation software
 - quality or reliability management systems
 - project management software

Opportunities for e-assessment

Assessment that is supported by information and communication technology (ICT), such as e-testing or the use of e-portfolios or social software, may be appropriate for some assessments in this unit.

If you want to use e-assessment, you must ensure that you apply the national standard to all evidence and that conditions of assessment (as specified in the evidence requirements) are met, regardless of the mode of gathering evidence.

Equality and inclusion

This unit is designed to be as fair and as accessible as possible with no unnecessary barriers to learning or assessment.

You should take into account the needs of individual learners when planning learning experiences, selecting assessment methods or considering alternative evidence.

Guidance on assessment arrangements for disabled learners and/or those with additional support needs is available on the [assessment arrangements](#) web page.

Information for learners

Professional Practice in Engineering (SCQF level 7)

This information explains:

- ◆ what the unit is about
- ◆ what you should know or be able to do before you start
- ◆ what you need to do during the unit
- ◆ opportunities for further learning and employment

Unit information

This project-based unit provides you with an opportunity to develop and apply your knowledge and skills in engineering to a realistic problem. It helps improve your professional practice and behaviours by developing your meta-skills.

The Higher National Certificate (HNC) in Engineering is for those who want to become engineering technicians and targets learners studying towards a qualification that develops core engineering design and analysis skills to support a career in engineering.

In this unit, you work as part of a small project team to design or develop, and evaluate a solution to a real-world engineering problem.

Unit outcomes

On completion of this unit, you can:

- 1 use engineering and digital skills to solve a real-world engineering problem
- 2 demonstrate team working skills
- 3 use project management concepts
- 4 use communication skills to communicate progress and solutions
- 5 develop own meta-skills in a vocational context

Outcome 1 — you use engineering and digital skills to solve a real-world engineering problem by comparing a variety of solutions. You consider the ethics, sustainability, quality and reliability of these solutions, before justifying a viable final solution.

Outcome 2 — you demonstrate your ability to work in a team by negotiating roles, responsibilities and problem solutions. You contribute to team meetings and lead aspects of team working. You evaluate the effectiveness of your team.

Outcome 3 — you use project management concepts to produce and maintain a project plan and risk register, and to identify and assign sub-tasks in a work breakdown structure. You learn how equality, diversity and inclusion impact project management. You also work to a project plan, by tracking the actions and progress of you and your team.

Outcome 4 — you use your communication skills to log and inform others of the progress of you and your team. You produce a professional, technical report on an engineering problem, possible solutions and the process your team used to arrive at the final solution.

Outcome 5 — you develop your own meta-skills in a vocational context. You reflect on the meta-skills, professional skills, digital technologies and digital skills that you have learnt and used while studying this unit. The meta-skills you develop and use include:

- ◆ self-management:
 - you develop the skill of focusing, as you work to a project plan
 - you learn to adapt, through team working compromises
 - you show initiative, when you take responsibility in ensuring successful team outcomes
- ◆ social intelligence:
 - you develop empathy with your team members
 - you show social conscience, when ensuring solutions are ethical and sustainable
 - you build relationships, while team working
 - you influence and inspire others, when leading team sessions for your co-workers
- ◆ innovation:
 - you recognise a problem, generate ideas and develop your holistic and logical thinking, when making sense of the problem and critically thinking of solutions

You are assessed by a variety of ways, including, but not limited to:

- ◆ a final professional, technical report
- ◆ logbook entries
- ◆ self-evaluation in reflective reports
- ◆ team-evaluation in reflective reports
- ◆ a project plan and risk register
- ◆ presentations on progress and results

Administrative information

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Superclass: AG

History of changes

Version	Description of change	Date
2.0	Outcome 1 evidence requirements and knowledge updated to include Learning for Sustainability.	March 2024

Note: please check [SQA's website](#) to ensure you are using the most up-to-date version of this document.