



Engineering Science

Assignment

General assessment information

This pack contains general assessment information for centres preparing candidates for the assignment Component of National 5 Engineering Science Course assessment.

It must be read in conjunction with the specific assessment task(s) for this component of Course assessment, which may only be downloaded from SQA's designated secure website by authorised personnel.

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Contents

Introduction	1
What this assessment covers	2
Assessment	3
General Marking Instructions	6

Introduction

This is the general assessment information for National 5 Engineering Science assignment.

This assignment is worth 60 marks. This is 40% of the overall marks for the Course assessment. The Course will be graded A-D.

Marks for all Course Components are added up to give a total Course assessment mark which is then used as the basis for grading decisions.

This is one of two Components of Course assessment. The other Component is a question paper.

This document describes the general requirements for the assessment of the assignment Component for this Course. It gives general information and instructions for assessors.

It must be read in conjunction with the assessment task for this Component of Course assessment.

The assessment task will be set and externally verified by SQA, and conducted, marked and internally verified in centres under conditions specified by SQA.

Equality and inclusion

This Course assessment has been designed to ensure that there are no unnecessary barriers to assessment. Assessments have been designed to promote equal opportunities while maintaining the integrity of the qualification.

For guidance on assessment arrangements for disabled candidates and/or those with additional support needs, please follow the link to the Assessment Arrangements web page: www.sqa.org.uk/sqa/14977.html

Guidance on inclusive approaches to delivery and assessment in this Course is provided in the *Course and Unit Support Notes*.

What this assessment covers

This assessment contributes 40% of the total marks for the Course.

The assessment will assess the skills, knowledge and understanding specified for the assignment in the *Course Assessment Specification*. These are:

- ◆ practical application of knowledge and skills from the Units to develop a solution to an appropriately challenging engineering problem
- ◆ skills in analysing a problem, designing a solution to the problem, simulating or constructing a solution to the problem, and testing and reporting on that solution

Assessment

Purpose

The purpose of this assessment is to generate evidence for the Added Value of this Course by means of an assignment.

Assessment overview

The assignment is a meaningful and appropriately challenging task, which should clearly demonstrate application of knowledge and skills, at an appropriate level, from both the *Mechanisms and Structures* and the *Electronics and Control* Units (as defined in the 'Further mandatory information on Course coverage' section of the *Course Assessment Specification*).

The assignment is designed to allow candidates to demonstrate their ability to work independently, as they are required to do in the other Component of the Course assessment, the question paper.

The assignment is set by SQA. A bank of assignments will be provided and centres may select from the bank.

Marks will be awarded for:

- | | |
|--------------------------------------|----------|
| ◆ Analysing the problem | 10 marks |
| ◆ Designing a solution | 10 marks |
| ◆ Constructing/simulating a solution | 20 marks |
| ◆ Testing the solution | 10 marks |
| ◆ Reporting on the solution | 10 marks |

The assignment will be internally marked by centre staff, in line with the Marking Instructions provided in this document.

Full instructions for candidates are contained within each assessment task.

Assessment conditions

Assessors must exercise their professional responsibility in ensuring that evidence submitted by a candidate is the candidate's own work.

This assessment is a single assessment event. Candidates should undertake the assessment at an appropriate point in the Course. This will normally be when they have completed most of the work on the Units in the Course.

This is an open-book assessment. There are no restrictions on the resources to which candidates may have access.

Candidates must undertake the assessment independently. However, reasonable assistance may be provided prior to the formal assessment process taking place. The term 'reasonable assistance' is used to try to balance the need for support with the need to avoid giving too much assistance. If any

candidates require more than what is deemed to be 'reasonable assistance', they may not be ready for assessment or it may be that they have been entered for the wrong level of qualification.

Reasonable assistance may be given on a generic basis to a class or group of candidates, for example, advice on how to develop a project plan. It may also be given to candidates on an individual basis. When reasonable assistance is given on a one-to-one basis in the context of something the candidate has already produced or demonstrated, there is a danger that it becomes support for assessment and assessors need to be aware that this may be going beyond reasonable assistance.

Clarification may be sought by candidates regarding the wording of a brief or specification or instructions for the assessment if they find them unclear. In this case, the clarification should normally be given to the whole class.

Some guidance may be provided during the analysis and design stages, but the candidate should work independently throughout the implementation, testing and evaluation stages.

Assessor input and advice on the candidate's analysis and design is acceptable in order to allow the candidate to progress to the next stages of the assessment. The assistance provided must be recorded so that the candidate's own analysis and design work can be marked/judged fairly.

As this assignment is a summative assessment, support and guidance during implementation, testing and evaluation stages should be limited to minimal prompts and questioning, referring the candidate to the instructions provided in the assessment task.

The assignment will be conducted under some supervision and control. Assessors should put in place processes for monitoring progress and ensuring that the work is the candidate's own and that plagiarism has not taken place. For example:

- ◆ regular checkpoint/progress meetings with candidates
- ◆ short spot-check personal interviews
- ◆ checklists which record activity/progress
- ◆ photographs, film or audio evidence

Group work approaches as part of the preparation for assessment can be helpful to simulate real-life situations, share tasks and promote team working skills. However, group work is not appropriate once formal work on assessment has started.

Once the assignment has been completed and submitted, it should not be returned to the candidate for further work to improve their mark.

Evidence to be gathered

The following candidate evidence is required for this assessment:

- ◆ the completed solution (model or photographs and/or hard copy from simulation software)
- ◆ a record of progress through the task (see below), including all items of evidence specified within the assessment task
- ◆ a short report on the testing of the solution (in written, electronic and/or oral form)
- ◆ evidence of candidate's degree of independence and safe working (detailed assessor observation notes)

This evidence must be retained for quality assurance purposes.

General Marking Instructions

Assessors should allocate a mark out of 10 for each of the six subsections, by following the instructions given below, and record this mark on the candidate assessment record, with a comment justifying why each mark was awarded.

Marks for internally assessed Components must be submitted to SQA by your centre. Evidence for this assessment should be retained in the centre for SQA quality assurance purposes. Further information on this will be provided by SQA.

For each of the sections, the assessor should select the band descriptor which most closely describes the evidence gathered.

Once the best fit has been selected, follow this guidance:

- ◆ if the evidence almost matches the level above, the highest available mark from the range should be awarded
- ◆ if the candidate's work just meets the standard described, the lowest mark from the range should be awarded
- ◆ otherwise the mark from the middle of the range should be awarded

Notes:

- ◆ If the evidence completely matches the highest level band descriptor for any section, and has been produced by the candidate working independently, 10 marks should be awarded for that section.
- ◆ Zero (0) marks should be awarded for any section where no evidence has been produced by the candidate.

Band descriptors

It should be noted that the band descriptors should be used as a guide to assessment, rather than as an exhaustive list and, where assistance is given to candidates, this must be reflected in the marks awarded and detailed in the marking commentary.

Band descriptors for section 1:

Analysing the problem: system specification, system and sub-system diagrams

	1 mark	2 marks	3 marks	4 marks
'Top-level' systems diagram	Incomplete system diagram, with missing/ incorrect inputs, process and outputs.	Complete and correct system diagram, showing all inputs, process and outputs.		
Sub-systems diagrams	Sub-system diagram, with numerous inconsistencies with sub-system interactions. No feedback.	Sub-system diagram, with some elements missing and/or some inconsistencies with sub-system interactions. No feedback.	Sub-system diagram, showing feedback, system boundary and interactions between sub-systems. Some detail missing.	Detailed and complete sub-system diagram, showing feedback, system boundary and interactions between sub-systems.
Specification	Incomplete specification.	Partially complete specification.	Complete specification, with some inconsistencies.	Complete and detailed specification.

Maximum marks available for section – 10 marks

Band descriptors for section 2:

Designing a solution: designing control and mechanical sub-systems

	1 mark	2 marks	3 marks	4 marks
Flowchart	Incomplete flowchart, displaying significant inconsistencies.	Incomplete flowchart, displaying some inconsistencies.	Partially complete flowchart, showing a small number of inconsistencies.	Complete flowchart, correctly detailing the control sequence to meet the specification.
Mechanical sub-systems	Basic design and sketches for appropriate mechanical sub-systems.	Design and sketches for appropriate mechanical sub-systems, including some appropriate calculations.	Detailed design and sketches for appropriate mechanical sub-systems, including correct and appropriate calculations.	
Structural sub-systems	Basic design and sketches for appropriate structural sub-systems.	Design and sketches for appropriate structural sub-systems, with basic annotations.	Detailed design and sketches for appropriate structural sub-systems, with clear annotations.	

Maximum marks available for section – 10 marks

Band descriptors for section 3a:

Constructing/simulating a solution: mechanical sub-systems

NB: Evidence must be provided for a constructed/simulated model of the structure and/or mechanism. A maximum of 5 marks are awarded for this.

Please note that a model must be the candidate's own work. Use of pre-built model without evidence of simulation will mean that the candidate will be awarded 0 marks.

For the remaining 5 marks, the materials and components used for the sub-system must be stated and fully justified.

	1 mark	2 marks	3 marks	4 marks	5 marks
Construction /simulation of mechanical sub-systems	Basic construction /simulation of one mechanical sub-system.	Construction /simulation of some mechanical sub-systems.	Construction /simulation of some mechanical sub-systems, with detail on some component values.	Construction /simulation of all mechanical sub-systems, with detail on some component values.	Construction /simulation of all mechanical sub-systems, with detail on all component values.
Justification of materials and components	Materials and components selected.	Basically justified decisions on materials and components given.	Justified decisions on materials and components, including basic information on material properties.	Justified decisions on materials and components, including basic information on material properties, comparing alternative materials.	Fully justified decisions on materials and components selected, including detailed information on material properties, component function, etc.

Maximum marks available for section – 10 marks

Band descriptors for section 3b:

Constructing/simulating a solution: electronic/control sub-systems

NB: Evidence must be provided for a constructed/simulated microcontroller/electronic sub-system, along with attached inputs and outputs (alternatively, evidence of a simulation would suffice). A maximum of 5 marks are awarded for this.

Please note that any model must be the candidate's own work. Use of a pre-built model without evidence of simulation will result in candidate being awarded 0 marks.

For the other 5 marks, a correct microcontroller code (to match the flowchart from section 2) must be included.

	1 mark	2 marks	3 marks	4 marks	5 marks
Construction /simulation of electronic/control sub-systems	Programmable control sub-system simulated and/or constructed, with numerous errors.	Programmable control sub-system simulated and/or constructed, with inconsistencies.	Programmable control sub-system fully simulated and/or constructed, including most input and output devices connected to the microcontroller , but with some inconsistencies	Programmable control sub-system fully simulated and/or constructed, including most input and output devices correctly connected to the microcontroller	Programmable control sub-system fully simulated and/or constructed, including all input and output devices correctly connected to the microcontroller
Microcontroller code	Incomplete microcontroller code detailed, which doesn't match the flowchart simulation.	Incomplete microcontroller code detailed, to partially match the flowchart simulation.	Partially complete microcontroller code detailed, to mainly match the flowchart simulation.	Complete microcontroller code detailed, to mainly match the flowchart simulation.	Complete microcontroller code detailed, to fully match the flowchart simulation.

Maximum marks available for section – 10 marks

Band descriptors for section 4:

Testing the solution

NB: Evidence for this section must include details of the tests planned and what outcomes were expected, details of the actual test results and details of any adjustments made as a result of the tests.

	1 mark	2 marks	3 marks	4 marks
Description of the planned tests	Test plan, covering some sub-systems. The plan states some tests to be carried out.	Logical test plan, covering some sub-systems. The plan describes some tests to be carried out, detailing actions and equipment/ software used.	Logical and thorough test plan, covering most sub-systems. The plan describes most tests to be carried out, detailing actions and equipment/ software used.	Logical and thorough test plan, covering all sub-systems. The plan fully describes all tests to be carried out, detailing actions and equipment/ software used.
Description of expected results	Expected results of some tests, covering some sub-systems stated.	Expected results of most tests, covering most sub-systems stated.	Expected results of all tests, covering all sub-systems detailed in a logical manner.	
Description of actual results and any amendments made	Expected results of some tests, covering some sub-systems stated.	Actual results of most tests, covering most sub-systems stated.	Actual results of all tests, covering all sub-systems detailed in a logical manner. Detailed descriptions of any amendments made to sub-systems, as a result of the testing.	

Maximum marks available for section – 10 marks

Band descriptors for section 5:

Reporting: keeping a record of progress, record of testing, and evaluation

NB: Evaluations should refer to the outcomes from section 4, comparing them with the original specification from the section 1 and suggest possible improvements to the system (5marks).

A full record of progress should include lesson-by-lesson details of what was done, any teacher assistance required and what was learned. For 5 marks, the record of progress should be complete and detailed.

	1 mark	2 marks	3 marks	4 marks	5 marks	6 marks
Evaluation	Very basic evaluation with inconsistencies.	Basic evaluation with inconsistencies. The evaluation compares few sub-systems with some specification statements.	Well-argued evaluation but with inconsistencies. The evaluation compares some sub-systems with some specification statements, stating how well the specification is met.	Clear, detailed, well-argued evaluation. The evaluation compares most sub-systems with associated specification statement(s) by referring to the testing results and describing how well the specification is met.	Clear, detailed, well-argued evaluation. The evaluation compares all sub-systems with associated specification statement(s) by referring to the testing results and describing how well the specification is met.	Clear, detailed, well-argued evaluation. The evaluation compares all sub-systems with associated specification statement(s), by referring to the testing results, describing how well the specification is met, and making recommendations for improvement, where appropriate.
Record of progress	A basic lesson-by-lesson record of what was done.	Lesson-by-lesson record of what was done.	Lesson-by-lesson record of what was done, what was learned and the level of teacher assistance received.	A detailed, lesson-by-lesson record of what was done, what was learned, the level of teacher assistance received, and plans for the next lesson.		

Maximum marks available for section – 10 marks

National 5 Engineering Science assignment (Record of progress — example extract)

The example below shows an extract from a possible candidate's *record of progress*, to provide an indication of the level of response required.

Note that the *record of progress* may be handwritten, or kept electronically (word processed document or blog entry), or spoken and recorded, or in any other appropriate format.

Name:	<i>A. Learner</i>
Date:	<i>02/03/14</i>

What I have done today:

Today, I completed my model. I took some photos of it to keep as evidence. I started working on my test plan.

What help I needed today:

The photos worked out Ok, but I had to get some help to download them to the computer and save them.

I wasn't sure what a test plan was – but my teacher explained that it just meant writing how I would check my model was working properly.

Evidence I have produced, and where and how it is stored:

The photos are flood1.jpg and flood2.jpg. They are in MyDocuments on the network.

I have started writing my plan on the stage 4a sheet.

Administrative information

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History of changes

Version	Description of change	Authorised by	Date
1.1	Clarification of evidence required to include assessor observation notes.	Qualifications Development Manager	July 2013
1.2	Introductory text added to band descriptors.	Qualifications Manager	August 2014
1.3	Amendments made to Marking Instructions for clarification.	Qualifications Manager	September 2015

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