Course Report 2016

Subject	Engineering Science
Level	National 5

The statistics used in this report have been compiled before the completion of any Post Results Services.

This report provides information on the performance of candidates which it is hoped will be useful to teachers, lecturers and assessors in their preparation of candidates for future assessment. It is intended to be constructive and informative and to promote better understanding. It would be helpful to read this report in conjunction with the published assessment documents and marking instructions.

Section 1: Comments on the Assessment

Component 1: question paper

Feedback indicated that the 2016 question paper was fair, balanced and accessible. The full range of marks was awarded in all questions and the paper appropriately sampled the course content as outlined in the Course Assessment Specification.

Analysis of the item performance and marker feedback showed that the question paper was set at a similar standard to the previous exams. This year the grade boundaries were maintained at their 2015 positions.

Component 2: assignment

The visiting verification model continues to provide opportunities to engage in supportive, professional dialogue enabling clarity to be given on the understanding of national standards. It has largely been well received by centres.

All verified centres used one of the assignments provided on the secure area of SQA's website — meaning that the instruments of assessment used were valid. Centres are reminded that candidates must be set a current assignment for the assessment of component 2 and that this cannot be adapted or altered in any way.

While the majority of verified centres used the CCTV assignment, it should be noted that a new assignment has been added to the bank this session. In addition to this, additional clarity was provided to support centres in deciding upon consistent assessment judgements. This took the form of a move from band descriptors (where a high level of subjectivity existed) to a more rigorous marks rubric. Again, this has largely been well received by centres.

Of the centres verified, the majority were assessing to national standards. Of those that weren't, most were lenient in their marking — some by a considerable margin. This would indicate that a number of centres still have issues when applying assessment criteria. Centres are encouraged to use the materials and commentaries, which are available through SQA's understanding standards activity, to aid in their assessment judgements.

Section 2: Comments on candidate performance

Areas in which candidates performed well

This year, the majority of candidates were well prepared for the question paper.

Calculation-based questions were consistently well answered, but it was noted that inappropriate significant figures in the final answer and incorrect or missing units were common errors.

Component 1: Question Paper

Question 1: candidates demonstrated a good understanding of closed loop control.

Question 3: most candidates correctly completed the truth table.

Questions 6(a)(b):	candidates could successfully apply their knowledge of simple gear trains.
Question 10(c):	the majority of candidates made a good attempt at calculating the current.
Question 13(b):	candidates consistently calculated the change in length.
Question 14(d):	most candidates could describe an advantage of using computer simulation.

Component 2: assignment

Candidates performed particularly well in the construction/simulation areas of the assignment as well as the inclusion of code. Flowcharts and mechanical system designs were also relatively well done.

Areas which candidates found demanding

Component 1: question paper

In the calculation questions, there was little evidence that candidates consistently followed the instruction on the front of the question paper: 'The number of significant figures expressed in the final answer should be equivalent to the least significant data value given in the question'.

Descriptive and explanation based questions tended to produce poorer responses with many candidates either failing to correctly interpret the command word or provide sufficient detail.

Question 2:	candidates often failed to describe an advantage of the use of a microcontroller and instead responded with basic statements, such as 'smaller' or 'cheaper'.
Question 4(a):	candidates found difficulty drawing the symbol for a shuttle valve in the circuit.
Question 6(b):	a small but significant number of candidates incorrectly rounded 1.6 recurring ($1.\dot{6}$) to 1.6 rather than 1.7.
Question 7:	many candidates calculated stress with an area value expressed in mm^2 but then used Pa as the final unit.
Question 10(a):	responses tended to be basic statements or generic points such as 'designed a circuit'.
Question 11(a):	a number of candidates responded with environmental or social impact statements rather than economic based descriptions.
Question 11(b):	the feedback was poorly attempted with many candidates not drawing the loop after the heater sub-system or showing the direction of the signal with an arrow head.
Question 12(b):	many candidates could not indicate where a unidirectional restrictor should be piped in order to slow the exhaust air.
Question 16(b):	a small number of candidates failed to answer this static equilibrium question despite attempting Question16(a).

Component 2: assignment

Section 1 - Analysing the Problem

Candidates should start off by providing a 'Top Level' Universal System Diagram to exemplify the whole system. From this, they should identify the required sub-systems (as it is National 5, it should utilise closed-loop control) and then provide a detailed system specification. This specification should cover all sub-systems identified, in addition to other considerations for the whole system. Detail should reflect the level being assessed (National 5).

Section 3a - Constructing / Simulating a Solution

Many candidates missed out the justification of materials and components, or wrote a bare minimum by stating a material choice. This is an open-book assessment, where candidates have access to reference materials and the internet. Justifications should compare material and component properties and characteristics of a number of materials and components before arriving at **justified** decisions. In order to attain full marks, a detailed response is required.

Section 4 - Testing the Solution

An awareness of timing is vital for this section. **Prior to the tests** candidates should provide details of what tests they plan to carry out (including what hardware and software is required, what they are going to do etc.) and detail the expected results from each of the tests. The planned tests must cover every sub-system (as identified in the specification) and detail each expected result.

After the tests candidates should detail the actual results of the tests, compare them against the expected results and detail any amendments made. Again, for full marks, this should be a detailed response - appropriate to the level being assessed and should cover all sub-systems.

Section 5 - Reporting

Similar to Section 4, the evaluation should be detailed and well-argued, covering **all** sub-systems — comparing them with every item in the specification and making recommendations for improvement.

Section 3: Advice for the preparation of future candidates

Component 1: question paper

Centres may wish to highlight to candidates that all calculation based final answers should be expressed in an appropriate number of significant figures. The Question Paper instruction states that this should be the same as the values used in the question. Answers that have two more figures or one less figure than this will be accepted.

Candidates need further guidance on the use of units for stress. Many appear to believe that Pa and $N mm^{-2}$ are interchangeable. Either version will be accepted, but if candidates use Pascal then the area used in the calculation needs to be expressed in m^2 and not mm^2.

A number of candidates failed to follow the instruction for flowcharts and did not include pin numbers or use the symbols shown in the Data Booklet. Centres may wish to emphasise this when covering this topic.

The descriptive and explanation-based questions were problematic for many candidates. Responses often ignored the question command word and tended to be just basic generic statements. Centres are encouraged to make use of past paper questions to help develop candidates skills in this exam technique.

A significant number of candidates did not attempt the Principle of Moments calculations and this indicates that centres may wish to focus on this aspect, including the use of the conditions of static equilibrium.

Component 2: assignment

As mentioned in Section 1, verification experience and statistical analysis suggests that centres are marking Component 2 too leniently.

There is also concern over the support that candidates are receiving as they progress through the assessment. **Please note** that this component is part of a national assessment, and the approach used should be one where no teacher support is given unless it is explicitly required by the candidate. In such cases, the marks awarded should reflect this assistance and this support should be noted on the marks sheet to justify assessment judgements. This assessment is open-book in nature and should be conducted in controlled conditions.

The assessment is a design task, with many possibilities at each stage. As a result, a variety of solutions would be expected within a cohort, with a range of presentation styles and structures. Pre-built models, either to use in the assessment or to exemplify possible solutions are not permitted. Templates for candidates to use are also not permitted.

Assessors should share the marking guidelines with candidates, and candidates should then structure **their** solution in any way they see fit.

Grade Boundary and Statistical information:

Statistical information: update on Courses

Number of resulted entries in 2015	1808

Number of resulted entries in 2016	1831

Statistical information: Performance of candidates

Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark -				
A	44.5%	44.5%	815	107
B	20.5%	65.0%	375	92
C	15.8%	80.8%	290	77
D	6.0%	86.8%	110	69
No award	13.2%	-	241	-

Decision Making Record Statement:

The course assessment performed as intended and so grade boundaries were set as intended.

General commentary on grade boundaries

- While SQA aims to set examinations and create marking instructions which will allow a competent candidate to score a minimum of 50% of the available marks (the notional C boundary) and a well prepared, very competent candidate to score at least 70% of the available marks (the notional A boundary), it is very challenging to get the standard on target every year, in every subject at every level.

- Each year, SQA therefore holds a grade boundary meeting for each subject at each level where it brings together all the information available (statistical and judgemental). The Principal Assessor and SQA Qualifications Manager meet with the relevant SQA Business Manager and Statistician to discuss the evidence and make decisions. The meetings are chaired by members of the management team at SQA.

- The grade boundaries can be adjusted downwards if there is evidence that the exam is more challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- The grade boundaries can be adjusted upwards if there is evidence that the exam is less challenging than usual, allowing the pass rate to be unaffected by this circumstance.

- Where standards are comparable to previous years, similar grade boundaries are maintained.

- An exam paper at a particular level in a subject in one year tends to have a marginally different set of grade boundaries from exam papers in that subject at that level in other years. This is because the particular questions, and the mix of questions, are different. This is also the case for exams set in centres. If SQA has already altered a boundary in a particular year in, say, Higher Chemistry, this does not mean that centres should necessarily alter boundaries in their prelim exam in Higher Chemistry. The two are not that closely related, as they do not contain identical questions.

- SQA's main aim is to be fair to candidates across all subjects and all levels and maintain comparable standards across the years, even as arrangements evolve and change.