



## Course Report 2015

Subject	Engineering Science
Level	Higher

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 examinations. 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 and marking instructions for the examination.

## Section 1: Comments on the Assessment

### Component 1: Question paper

A total of 61 centres presented candidates this first year. It is also pleasing to be able to report that the number of candidates presented for Engineering Science this year, is an increase on the number of candidates presented for Higher Technological Studies last year.

The analysis of the question paper showed that the 2015 exam was fair, balanced and accessible. The full range of marks was awarded in all questions and the assessment was found to function as intended.

A review of candidate performance in the question paper found that the level of demand was slightly greater in the questions which examined topics which were not covered in the Higher Technological Studies paper, though in all cases the full range of marks were awarded.

Grade boundaries were increased from notional levels by 4 marks. This was to account for an ease in demand through the application of the marking of the Course assignment, and the wording of a question in the question paper which may have unintentionally increased the demand.

### Component 2: Assignment

A number of centres were verified in this session.

This was the first year that visiting verification took place for the IACCA. This had many advantages, including the opportunity for centres to display video evidence of system simulation, and the invaluable opportunity to provide one-to-one feedback to assessors, supporting their understanding of the National Standards.

All centres verified used one of the SQA assignments provided on the secure site — meaning that the instruments of assessment used were valid. Centres should be aware that it is **mandatory** for centres to use one of the assignments from the **current** SQA bank for the assessment of Component 2.

A number of centres were found to be lenient in the marking of the assignment. Centres are reminded of the additional materials, Understanding Standards events and materials published on the Understanding Standards websites, which are intended to assist assessors applying the marking instructions.

## Section 2: Comments on candidate performance

### Component 1: Question paper

Most candidates presented this year were generally well prepared for the question paper. Calculation-based questions were consistently well answered. The descriptive questions

produced more mixed responses, though questions on engineering roles and skills were generally well done. The pneumatic question had mixed responses, with candidates describing the function well although some had difficulty explaining the principles of sequential control. The question examining the design of a circuit was poorly done.

## Component 2: Assignment

To account for an ease in demand through the application of the marking instruction of the Course assignment an increase in 4 marks was applied to each of the grade boundaries.

After the experience of National 5 last session, where additional clarity was provided to the Band Descriptors, similar additional clarity will be provided for assignments for 2016. Holistically, assessors should decide on what band a candidate's work should sit in, and then decide on a mark within that band. The additional clarity also assists assessors by providing information on the weighting applied to specific parts of some sections.

## Section 3: Areas in which candidates performed well

### Component 1: Question paper

Question 1: The majority of candidates correctly described the stress/strain questions.

Question 4: Although some candidates misread this question, most were able to describe engineering skills correctly.

Question 6: Candidates made a good attempt at calculating the power, but a common mistake was made in the use of the 5% energy loss, though overall the question was well done.

Question 9 (a): Candidates were generally able to describe social, economic and environmental effects in this application

Question 10 (b): The majority of candidates were able to score 5 or more out of 7 by describing the function of the pneumatic circuit.

### Component 2: Assignment

Where evidence was provided, candidates performed well in the simulation aspects of the Assignment. It should be stressed that:

- ◆ As this is a summative assessment, evidence must be provided. Observational evidence is not appropriate. Where no evidence is present, candidates should be awarded **0 marks** for that section.
- ◆ For evidence of flowchart simulation, any printout should include the microcontroller simulation, with inputs and outputs attached. A flowchart on its own is not appropriate evidence of a simulation having taken place.
- ◆ As the model for verification is now one of visiting, centres can now provide video evidence of simulation. If this is the case, video files should be separately named with the name of the candidate.

## Section 4: Areas in which candidates found demanding

### Component 1: Question paper

Question 2: This question received mixed responses. Some candidates were able to give clutch advantages and disadvantages, but many found it, difficult.

Question 3: Some candidates had difficulty in describing the function of the MOSFET

Question 7 (b) (ii): Some candidates did not correctly justify their choice of control system.

Question 9 (d) Some candidates did not calculate the resistor values required to give the correct operational amplifier function and add these values to their design.

Question 10 (a): A number of candidates were unable to explain the principle of sequential control using group air. This topic has not previously been examined in the Higher Technological Studies Course.

Question 10 (c): Candidates found challenge in justifying their choice of location for the restrictor.

### Component 2: Assignment

Candidates found the following areas demanding:

**Analysis:** This should include three main aspects: top-level, generic systems diagram; control diagram (including closed loop control, systems boundary, etc); and full specification. If the specification items are numbered, they can be referred to in the testing and evaluation.

**Test Plan:** This should include three main aspects: details of the test to be carried out (including detail of hardware and software required); information on the expected outcome; and actual results. Some candidates find that a table is an appropriate way of presenting this information, although it is not the only method. There should be a **minimum of one test for each sub-system** identified.

**Evaluation:** This should reflect on the outcomes of each test, comparing it to the expected results and the original specification. It should also include details of any alterations to the system throughout the process and suggestions for further improvement.

**Record of Progress.** Some candidates merely write a couple of words like 'ok' or 'works fine'. These are not Higher level responses. The Record of Progress is an important reflective record of a candidate's learning. It also serves as additional evidence for verification purposes. Candidates should detail, for each lesson, what they have learned, what they have achieved, any help they have received, and what they plan to do next lesson.

## Section 5: Advice to centres for preparation of future candidates

### Component 1: Question paper

The questions including material or principles not previously examined at Higher were found to be challenging by many candidates. Centres are encouraged to make use of this year's question paper, the specimen paper and the practice paper to prepare candidates for questions in pneumatics, MOSFETs, clutches and bearings, and energy.

This year saw many candidates round up the final answers. Centres are reminded that, in future, examination final answers will be expected to be expressed in the same number of significant figures as the least significant data value in the question. Correct answers expressed up to two significant figures more or one less will also be accepted.

Candidates found the question requiring the design of an operational amplifier circuit to a particular specification challenging. Practice in this area during lessons would be advisable.

More in-depth explanation and justification is required at this level. It would be beneficial for candidates to practice using past, specimen and practice question papers.

Though answers around the skills, knowledge and roles of engineers were well done by many candidates, some candidates are still unclear about the level of detail required and so more practice in this area should be considered.

### Component 2: Assignment

Centres are reminded that the assignment is a way to assess a candidate's problem-solving skills. They should work through a **process** to use knowledge learned in the Course to solve a practical engineering problem.

For this reason, candidates should be encouraged to build thoughtful, analytical skills throughout the course in preparation for the assignment. Centres should note that the Assignment is open-book in nature. This means that candidates are able to access course notes, practice assignments, online resources etc, and use them in their own assignment.

As this is Higher Grade, no scaffolding should be provided to support candidates. They should not be provided with templates, and should be able to structure the report in any way they choose. Evidence for each band can be found in any part of the report and marks can be assigned accordingly. Even if a class cohort attempts the same assignment, it would be reasonable to expect very different responses from each candidate. However, where teacher assistance is given, due cognisance of the level of support should be taken into account when marks are being allocated.

It is also crucial to note the level of support provided in the justification of mark allocation for verification purposes.

## Statistical information: update on Courses

Number of resulted entries in 2014	0
Number of resulted entries in 2015	881

## Statistical information: Performance of candidates

### Distribution of Course awards including grade boundaries

Distribution of Course awards	%	Cum. %	Number of candidates	Lowest mark
Maximum Mark - 150				
A	25.9%	25.9%	228	109
B	27.2%	53.1%	240	94
C	20.9%	74.0%	184	79
D	9.8%	83.8%	86	71
No award	16.2%	-	143	

For this Course, the intention was to set an assessment with grade boundaries at the notional values of 50% for a Grade C and 70% for a Grade A. The question paper was to standard, however it was felt that there were two instances where the layout/ wording of a question would have detrimentally affected candidates; this led to a decrease of 2 marks to all of the grade boundaries. Additionally, it was felt that the application of the marking instructions of the course assignment has led to an easing of demand; this led to an increase of 6 marks to all grade boundaries. The net result is that all grade boundaries were increased by 4 marks.

## 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.