

Principal Assessor Report 2005

Assessment Panel:

Engineering

Qualification area

**Subject(s) and Level(s)
Included in this report**

**Electronic and Electrical Fundamentals
Intermediate II**

Statistical information: update

Number of resulted entries in 2004	98
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Number of resulted entries in 2005	85
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General comments re resulted entry numbers

It is disappointing to report that the number of entries for the Electronic and Electrical Fundamentals Examination reduced from 98 in 2004 to 85 in 2005. This represents a 13% reduction in entry numbers.

Such a reduction is of even greater concern when it is noted that more than half the entries came from one overseas centre and if this centre had not presented any candidates Scottish based candidate entries would have fallen to about 40, compared with 52 last year. Furthermore only one school continues to submit entries and the number of colleges submitting candidate entries fell to only 3 in 2005 compared with a peak of 8 in earlier years.

It was hoped that the actions taken by the setting and vetting teams to make the paper more user friendly to both schools and colleges (e.g. introducing both conventional and electron flow into questions) would attract larger entry numbers. However, this has not proved to be the case.

On the positive side the introduction of a new Electronics course at Intermediate I with steadily growing numbers may feed through candidates to the Electronic and Electrical Fundamentals course. However, the setting and vetting teams both believe there is a need to actively market the Electronics and Electrical Fundamentals course especially in schools. The teams believe that the course may provide a very useful supplementary course to Highers in Physics, Technological Studies and some of the science Highers. The teams are now convinced that the standard of the Electronics and Electrical Fundamentals is at Intermediate II level.

Statistical Information: Performance of candidates

Distribution of awards including grade boundaries

Distribution of awards	%	Cum %	Number of candidates	Lowest mark
Maximum Mark-	-	-	-	-
A	20.0	20.0	17	65
B	18.8	38.8	16	58
C	20.0	58.8	17	50
D	0.0	58.8	0	40
No award	41.2	100.0	35	-

General commentary on passmarks and grade boundaries

- While SQA aims to set examinations and create mark schemes which will allow a competent candidate to score a minimum 50% of the available marks (notional passmark) and a very well-prepared, very competent candidate to score at least 70%, it is almost impossible to get the standard absolutely on target every year, in every subject and level
- Each year we therefore hold a passmark meeting for each subject at each level where we bring together all the information available (statistical and judgmental). 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 senior management team at SQA
- We adjust the passmark downwards if there is evidence that we have set a slightly more demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- We adjust the passmark upwards if there is evidence that we have set a slightly less demanding exam than usual, allowing the pass rate to be unaffected by this circumstance
- Where the standard appears to be very similar to previous years, we maintain similar grade boundaries
- 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 are different. This is also the case for exams set in centres. And just because SQA has altered a boundary in a particular year in say Higher Chemistry 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
- Our main aim is to be fair to candidates across all subjects and all levels and maintain standards across the years, even as arrangements evolve and change.

Comments on any significant changes in distribution of awards/grade boundaries

Previous Principal Assessor's Reports have commented on how the setting and vetting teams took actions to adjust the standard of the Electronic and Electrical Fundamentals examination to conform to Intermediate II standards. These actions included the following:-

- Using certain new terms that candidates' might more easily understand
- Reducing the complexity of certain of the electrical fundamentals and analogue electronics questions
- Reducing the level of integration of subject matter in Section B of the examination paper (i.e. have one question that is essentially analogue electronics in nature, one question that is electrical fundamentals in nature and one combinational logic question)

The results from 2003 and 2004 showed that the incorporation of the above actions helped to establish more appropriate standards. In fact, the National Ratings have gradually moved from highly negative in the early years of the qualification to +0.30 for the 2004 Examination.

The 2005 Examination paper represented the first paper post the 'standards adjustment process' although it was modelled very much on the 2003 and 2004 papers. It has to be reported that candidate performance in 2005 was not as good as in 2004. For example, the mean mark in 2005 was 50% compared with 59% in 2004. Based on a Grade A boundary mark of 70% 12 candidates achieved Grade A in 2005 compared with 36 candidates in 2004. The actual Grade A passes has been raised to 17 as a result of reducing the Grade A boundary mark to 65%. The number of candidates achieving Grade C or better was lower at 58.8% compared with 67% in 2004.

It is possible to argue that the reduction in candidate performance in 2005 reflects a slight stiffening of the 2005 Examination paper. However, it must also be reported that all candidates performed poorly with regard to Question 9 suggesting that the question was not clearly enough expressed and did not adequately discriminate between Grade C and Grade A candidates. This was the principal reason why the Grade A boundary mark was lowered from 70% to 65% with the Grade B boundary mark automatically adjusted to 58%.

It must also be reported that many candidates passed the Examination paper principally on the basis of a reasonable performance in Section A and a very good performance in answering Q.11, the Digital question in Section B. Q.12 in Section B, the Electrical Fundamentals questions, was answered by most candidates but marks were typically 10 or less out of 25. Q.10, the Analogue Electronics questions, was only answered by a few candidates and was not answered well. This type of performance has been typical over a number of years and raises serious issues as to whether candidates should be offered a choice in Section B.

Comments on candidate performance

General comments

As already noted there has been a decline in the performance of candidates in the 2005 Examination compared with the 2004 Examination. In 2005 58.8% of candidates passed the Examination compared with 67% in 2004.

At 50%, there was also a significant reduction in the candidate mean mark in the 2005 paper compared with a mean of 59% in the 2004 paper. As already commented this reduction in mean mark might reflect a slight stiffening of the Examination paper in 2005. The decrease in mean mark may also be a result of difficulties candidates experienced in answering Q.9, which as already commented was not well expressed and was too stretching.

It is interesting to note that there was a higher concentration of candidates with C grades (17 candidates) in 2005 compared with 8 candidates in 2004 while there were a lower number of Grade A (17 candidates) in 2005 compared with 36 in 2004. This clearly indicates the reduction in candidate performance in 2005 compared with 2004. As commented previously many candidates achieved a pass mainly because of a very good performance in Q.11, the Digital question, in Section B.

As in previous papers the combinational logic questions were the most popular and the best answered with the notable exception of Q.9. Candidate responses to the Electrical Fundamentals questions continue to be reasonably good although candidates struggled with Q.12 (c) involving a new speed when the output voltage changed which indicates a lack of understanding of applying proportionality. It is also pleasing to report that some candidates continue to demonstrate competence in transposing simple equations, entering values into the transposed equation and arriving at the correct answer. As in previous examinations, the analogue electronics questions were the least well answered. The issue of the poor answering of analogue electronics questions has been commented on in a number of PA Reports and is an on-going problem in electronic engineering courses at all levels (see comments in the section on Feedback to Centres).

It is also pleasing to report, that as was the case with last three years' paper, there was clear evidence that candidates were using better exam techniques when attempting the Intermediate 2 paper

Areas of external assessment in which candidates performed well

- Q.1 As usual the number conversions were done well by most candidates.
- Q.3 (c) Part (c) of this question, the most difficult part of the question, was answered well by most candidates.
- Q.5 This question was answered well apart from part (c) where candidates had to show how a 3-input OR gate could be replaced by 2-input OR gates.
- Q.6 The operational amplifier question, including the calculation of R_f , was generally answered well.
- Q.8 This question was generally answered well.
- Q.11 As commented previously, this question was answered well by almost all candidates attempting it. It is pleasing to report that many candidates identified the fault condition in Q.11 (e).

Areas of external assessment in which candidates had difficulty

- Q.2 (c) A significant number of candidates failed to add the 2.1V volt drop across the diode to the volt drop across the 220Ω resistor to obtain the maximum value of dc input voltage.
- Q.3 (a) Surprisingly many candidates did not recognise that 24 amperes was the maximum value of the sinusoidal current.
- Q.4 (a) Many candidates failed to indicate what current convention they used to answer this question.
- Q.7 The same difficulties were observed as in previous years: many candidates could not identify the circuit configuration or the names of the terminals (some candidates confused the names of the terminals with those for bipolar transistors).
- Q.9 This question has been commented on earlier. It was noted that some candidates used BS symbols even though the question specifically asks for the use of ANSI symbols.
- Q. 10 (a) This part of Q.10 was poorly answered. Candidates appeared not to read the question properly. They assumed the diodes in the three diagrams were all the same. Also candidates appeared to take their current values (I_{Fmax}) straight from the data sheet rather than calculating currents from given conditions in the circuits.
- Q.10 (c) (iii) Candidates did not understand why the gain of the amplifier falls drastically when C_E is removed.
- Q.10 (d) (ii) Candidates seemed unable to explain the need for offset null adjustment.
- Q.12 (c) (ii) As noted earlier few candidates appeared to be able to apply the principle of proportionality to get the new generator speed.
- Q.12 (e) Some candidates failed to use the Worksheet provided to answer this question.

Recommendations

Feedback to centres

This year's results show a decline in candidate performance. The mean mark fell from 59% in 2004 to 50% in 2005. The pass rate declined from 67% in 2004 to 58.8% in 2005. This change in candidate performance can partially be explained by a slight stiffening of the Examination paper in 2005. The SQA National index for 2004 revealed that the 2004 Examination paper was slightly below Intermediate 2 level requiring this slight adjustment in standard for 2005. It was also noted that Q.9 in the 2005 paper was poorly answered by all candidates suggesting the question was too stretching even for Grade A candidates.

Number of entries for the Electronic and Electrical Fundamentals Examination continue to be just below 100 (in fact, there was a decline in numbers this year - 98 last year compared to 85 this year). Unless numbers of entries increase the long term viability of the Examination must be in question. Schools/Colleges offering the new Intermediate I Electronics course are encouraged to consider letting their pupils/students go on to study the Electronics and Electrical Fundamentals course. Colleagues in schools are also encouraged to consider offering the Electronic and Electrical Fundamentals course as a useful supporting course to Highers in Physics, Technological Studies and other science/technological studies based courses.

The setting and vetting teams continue to be concerned about the number of poor responses they see from candidates in the analogue electronics questions. The teams recognise that candidates' tend to find this subject area more difficult than the combinational logic area. It is clear from seeing a large number of candidate responses that the amplifier configuration type questions (both BJT and FET) prove particularly difficult for candidates (this is not the case with the operational amplifier questions). Colleagues in schools and colleges are encouraged to explore ways of improving candidates' knowledge and understanding of what is traditionally a difficult subject area.