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General Certificate of Education

Electronics 1431/2431

ELEC2 Further Electronics

Report on the Examination

2009 examination - June series

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Registered address: AQA, Devas Street, Manchester M15 6EX
Dr Michael Cresswell Director General

General Comments

This is the first examination of the new specification. During the revision, some topics were removed completely from the overall specification, while other topics were moved to different units. The details of the changes to content are available on the Teacher Resource Bank.

The aim of these changes was to make ELEC1 and ELEC2 unit examinations more evenly matched. ELEC1 and ELEC2 are also now evenly weighted in the overall award, with each examination being worth 67 marks and of one hour duration.

The examination reflected the style of the previous specification papers, with questions being set in the context of real applications wherever possible, so recognising the importance of electronics in the real world.

This module examination tested the Further Electronics module of the AS Electronics specification, as well as the basic knowledge acquired from the introductory module, ELEC1. 50% of the marks were based on standard bookwork and should have been readily available to all candidates who had studied the course and undertaken some revision. All sections of the specification were examined and it is expected that this will continue in future years.

This year, the papers were marked via an online viewing system and so the presentation and handwriting of candidates was even more important. While the presentation and handwriting of some candidates was excellent, a significant number of candidates produced scripts that were problematical for examiners. Candidates communicate with examiners via their handwriting, and all too often their responses were verging on being illegible. Candidates need to be reminded that examiners must be able to read responses if they are to gain any credit. Candidates should also consider crossing out errors with a single line and not producing a scribbled mess over which they attempt to write a modified answer.

All of the marks were gained overall by candidates, with no marks being inaccessible. Marks ranged from 0 to 66, with the mean mark being 32. As in previous examinations, candidates gained credit for all responses that contained correct electronics.

Question 1

This question was intended to provide a familiar introduction to candidates, since much of the coursework produced by candidates for ELEC3 contains at least one 555 timer.

For section (a), candidates were required to show how they would connect the LED, series resistor and buzzer for the kitchen timer application. Many candidates were able to add the LED and series resistor successfully, but a large number were not able to connect the buzzer appropriately. It is of concern that a significant number of candidates made no attempt at completing the circuit diagram.

Section (b) required candidates to identify the maximum value of the timing resistor from the circuit diagram and then, using the correct formula from the data sheet, calculate the maximum time period. Again, while a significant number of correct calculations was seen, there was a worryingly large number of candidates who seemed unable or unprepared to carry out such calculations.

Section (c) required candidates to explain how a 555 monostable circuit operates. Answers for this ranged from no attempt, through vague waffle, to responses that resembled the mark scheme from candidates who had obviously learnt the description. Such descriptions of the operation of circuits are likely to feature in future examinations.

Question 2

This question was also intended to be straightforward and was based on the 555 astable circuit.

For section (a), candidates were required to complete the circuit diagram for the astable. If candidates had just extended the 555 input connections to the timing circuit, they would have gained two of the three marks, so it is of concern just how many candidates did not gain any marks in this section. This really is basic bookwork.

Section (b) was more demanding, requiring candidates to chose the correct formula from the data sheet and then calculate a suitable value for R. It was encouraging to see that a pleasing number of candidates were able to do this successfully and gain all three marks.

Those candidates that were able to answer section (b) usually gained marks in section (c). A common error was for candidates to forget to include the value of the resistor that they had calculated for section (b).

Either a NOT gate or an inverting amplifier was a suitable response for section (d), and many candidates readily gained this mark. It is worrying, though, just how many candidates made no attempt at this section.

Question 3

This question should have provided few difficulties to candidates.

Section (a) was a straightforward application of the time constant formula and, while there were many correct responses, a significant number of those attempting the question had problems with powers of ten.

Section (b) required candidates to draw the circuit diagram of a non-inverting amplifier with a voltage gain of +5. Part (i) covered the circuit diagram, and it is of concern just how many incorrect attempts were made. This is fundamental bookwork and yet seemed beyond the range of too many candidates. Those candidates making a successful attempt at part (i) usually gained credit for part (ii), with sensible values for the resistors to give the required circuit a gain of 5.

For section (c), a large number of candidates seemed unaware that the input resistance of a non-inverting amplifier is extremely large, preferring instead to concentrate on the non-inverting property of the amplifier.

Question 4

This was intended to be a straightforward question on D-type flip-flops and counters.

Section (a) required candidates to explain that D is copied to Q on the rising edge of the clock pulse. The question was worded so as to elicit this response, so it is of concern that many candidates were unable to give this answer.

Section (b) was a standard modulo-10 counter circuit and was answered well, with almost all candidates managing to remember something that was creditworthy to add to the circuit diagram.

It was expected that all candidates would gain credit for section (c), by decoding the binary value to decimal and then shading in the appropriate segments of the display to show the figure 9. A common but incorrect response was 3, and it is unclear to the examiners how candidates arrived at this value.

Question 5

This question tested a new area of the specification and should have been anticipated by candidates.

Section (a) required candidates to complete the circuit diagram for the difference amplifier and, in general, this was poorly attempted. It was clear that some candidates were meeting this circuit for the first time.

For those candidates who were familiar with the difference amplifier, section (b) gave few difficulties, though too many candidates managed to get the formula upside down and so gave values of 2kΩ.

Section (c) was probably the most demanding part of the paper and so it was pleasing to see candidates attempting this, even if many responses gained no credit. Candidates who were familiar with similar questions on noise reduction in cables from the previous specification usually gave creditworthy responses. Many physics students gave responses in terms of interference, which did not gain marks.

Question 6

This question was intended to be straightforward and to test the inverting and summing amplifier circuits.

Section (a) part (i) asked candidates to identify the virtual earth point on the circuit, and it is of concern that so many candidates still seem unable to do this correctly.

Asking for the input resistance of the amplifier for part (ii) was more demanding, but many candidates were able to identify this correctly.

Calculating the voltage gain for part (iii) produced good responses from most candidates, though a significant number omitted the minus sign and so failed to gain a mark.

Section (b) was well answered by candidates, many adding the resistor in the correct place and giving it an appropriate value.

Section (c) was demanding, but most of those candidates attempting this section gained credit.

Question 7

This question was based on the standard MOSFET push-pull amplifier which should have been familiar to all candidates.

The problems for candidates started in section (a), when they were asked to draw the two MOSFETs. For some reason, drawing a MOSFET symbol seems to be beyond the ability of many candidates, so asking for two different MOSFETs appropriately connected in a circuit was just too much, with this section often not being attempted.

Many candidates were able to explain cross-over distortion for section (b) part (i) and often included diagrams to aid their explanations.

The steps already used within the circuit to minimise cross-over distortion for section (b) part (ii) caused problems, with candidates often citing either the biasing of the MOSFETs or the negative feedback, but not both.

The power calculation in section (c) was usually creditworthy by those candidates who attempted this section, but all too often this section was not attempted.

Section (d) required candidates to explain why the output power would be less than the calculated value and was often well answered by those candidates who were still working at the paper. Vague answers based on components getting hot were not usually rewarded, but any of the main ‘voltage drops’ gained credit.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the **Results statistics** page of the AQA Website.