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General Certificate of Education (A-level)
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Electronics ELEC4

(Specification 2430)

Unit 4: Programmable Control Systems

Report on the Examination

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General Comments

This module examination tested the Programmable Control Systems module of the A2 Electronics specification as well as the basic knowledge acquired from the AS modules.

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

When constructing the examination, 50% of the marks were based on standard bookwork which 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 again marked via an online viewing system and so the presentation and handwriting of candidates was very important. While the presentation and handwriting of some candidates was excellent, a significant number of candidates produced scripts which were difficult to read. 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.

This report should be read in conjunction with the question paper and the mark scheme.

Question 1

This question was intended to provide a gentle introduction to the paper.

(a) Many correct responses were seen but a large number of candidates had difficulty with the arithmetic. All too often 11 - 3 often did not equal 8, and 60 divided by 8ms resulted in a wide variety of answers.

(b) Most candidates gained some credit by mentioning either noise or digital logic levels, but few mentioned both.

(c) Many creditworthy answers were seen though some candidates forgot to calculate the parallel resistor combination first. Others succeeded in reversing the switching levels of the Schmitt trigger.

(d) Most candidates gained some credit, but too many candidates forgot that the Schmitt trigger circuit was inverting and others forgot to show the vertical transitions at the correct switching levels.

Question 2

This question enabled all candidates to gain some credit for their attempts.

(a) Most candidates successfully identified the virtual earth point, though a wide variety of letters were used for this purpose.

(b) Many clear and concise answers from those who used $V_{out} = I_d \times R_f$. Candidates using the gain formula usually gave incorrect and confused responses.

(c) Many correct solutions, though those candidates using the inverting amplifier gain formula were often less successful than those who realised that $V_{out} = I_d \times R_f$, and then substituted values.

(d) Many creditworthy attempts were seen, though much confusion between flow charts and subsystem diagrams. A few candidates were able to clearly and succinctly express how the focussing system would work with a flow chart and so gained full marks.

Question 3

This question tested the Robotic section of the specification with a real application.

(a) Many creditworthy responses were seen, but a large number of candidates believed that the vacuum cleaner could be powered from solar cells or petrol engines!

(b) Again many creditworthy responses were seen, but too many answers for (iv) were too general and did not refer to this application. Worryingly some candidates seem not to have heard about artificial neural network systems.

(c) It had been hoped that by now all candidates would be able to draw a MOSFET H-bridge circuit. However, this proved not to be the case. While many creditworthy responses were seen, there were still problems with drawing MOSFET symbols. Many candidates still seem confused with push pull amplifiers and so used source follower arrangements rather than common source switches.

Question 4

This question was linked with Q5 to provide a real application e.g. a data logger. However, neither question depended upon the other.

(a) Many correct answers were seen, though too many candidates thought that there were only 16 bits (A_0 - A_{15}) resulting in 2 bytes of memory.

(b) While many correct and creditworthy answers were seen, too many candidates appeared to have learnt little programming and so even the listing of the assembler instructions in the data sheet seemed to provide little stimulus for their responses.

(c)(i) This was AS material and the responses were very disappointing. There was general confusion for many candidates between counters and shift registers with data latches rarely being drawn. Those who did draw latches often forgot to label the inputs, outputs and latch select as requested.

(c)(ii) Many creditworthy responses were seen, though candidates often failed to mention that the data must be present on the inputs *before* the latch select is pulsed high.

Question 5

This question was linked with an application in Q4.

(a) Many creditworthy responses were seen but some candidates missed the focus of the question and identified the RAM as losing its data when powered down, therefore being only temporary storage.

(b) Too many candidates failed to compare the two types of ADC and so lost marks. Some believed that digital ramp ADCs are more complex than flash ADCs.

(c) Many creditworthy responses were seen though some candidates did not know which was the MSB and LSB of a binary number and so gave bit 5 as an incorrect response.

(d)(i) Again many creditworthy responses were seen but often attempts were vague and indicated that 'active low' was an unfamiliar concept for many candidates.

(d)(ii) There were some very clear, succinct answers, but many candidates had little idea what was happening and so just wrote out what the code meant, often incorrectly.

(e) This part produced many correct responses.

Question 6

This should have been the most accessible question on the paper and while there were some very good responses, too many attempts were vague.

(a)(i) Many creditworthy responses were received which mentioned the accuracy/precision of rotation of the stepper motor. Credit was not given for answers involving resolution, since for many stepper motor systems the resolution is not as good as that which can be achieved with a conventional motor.

(a)(ii) Again there were many responses which gained credit, though too many were too vague.

(b)(i) Many creditworthy responses were seen, though too many candidates believed that the system was open loop and so could gain no marks.

(b)(ii) Most candidates gave correct responses to this part, but a significant number appeared to have little idea what the question was asking.

(c)(i) Many candidates were aware of the alignment issue but often worded their responses too generally to gain full marks. Many suggested that the problem was because the microcontroller could not read the data fast enough.

(c)(ii) Most candidates knew that there was only 1 bit/change but few mentioned that misalignment issues were eliminated.

Question 7

The first part of this question required candidates to be able to consider the attributes of the two type of display shown in the question. The responses received were disappointing and often did not include a comparison as requested in the question. The responses to the second half of the question were, on the other hand, encouraging.

(a)(i) Few fully correct responses were seen and too many thought that LCDs used more current than LED displays.

(a)(ii) Few correct responses were seen. Some candidates only identified dark conditions or light conditions but not both, while others believed that LED 7-segment displays were always more visible.

(a)(iii) Few correct responses were received with many being too vague to gain credit. Too few candidates looked at the pictures given in the question and adapted their responses accordingly.

(b) Many answers gained credit often with full marks. However, other responses showed little understanding of what was required.

(c) Many correctly minimised responses were seen and other creditworthy responses showed various efforts to convert the circuit to NAND gates only.

Mark Ranges and Award of Grades

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