GCSE

Electronics

44301 – Written Paper
Report on the Examination

4430
June 2013

Version: 1.0

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General Comments

Since this is now the third year of the current specification in GCSE Electronics, candidates will have had the benefit of using the previous two years papers and also the specimen paper in their preparation for this year's examination. Furthermore, past papers from the previous specification are still useful despite changes from the previous specification in terms of the arrangement of assessment units, the subject content and the style of questions have however been retained since the subject matter itself has seen little change and is well understood and practised by most teachers teaching this course,

Yet again, the content of this year's paper has retained the pattern set by previous papers including the specimen paper, where the first five questions are short answer questions primarily aimed at the lower ability candidates, but still containing material that will make all candidates think; this is then followed by longer more searching questions, which although aimed at the higher ability candidates, contain sections of higher accessibility. In this way, a paper is created that meets the requirements of the specification that would also look familiar to those candidates who had prepared well for this examination by practising on past papers.

The length of the paper and the mark total continues at 2 hours and 150 marks. This makes for a very full paper and a busy couple of hours. Nevertheless, most candidates seem to cope with this well, they seem to have enough time to complete their answers to the paper. The benefit of the single paper is that there is no need to decide on the appropriate tier of entry for each candidate. The outcome continues to be successful in that there were again very few candidates who scored very low marks, at the other end of the spectrum, there was adequate challenge in the paper for high ability candidates. The overall distribution of the marks continued to be wide.

In conclusion, most candidates this year again seem to have found plenty that they could attempt on the paper. It seemed possible for candidates to answer all they could attempt in the time available, there was little evidence of unfinished questions towards the end of the paper but rather that most candidates were prepared to have a go and put something down even though they could not provide a valid answer, rather than unanswered questions possibly indicating that they were running out of time. It is again pleasing to note that this year; candidates obtaining a grade A on the paper were scoring around 80% of the marks, evidence of real achievement.

Question 1

This question as always was about electrical safety and started by testing knowledge of mains wire names and colours. In section (a) part (i) nearly all answers were found to be correct. Instead of live and neutral, a few "negatives", and fewer "positives" were seen, earth and ground were both given credit for the third wire although some answers include both of these.

In section (a) part (ii) most candidates actually read the question and their responses were mainly correct – a few gave names not colours and more marks were lost because of this rather than because blue and brown were confused. Careful perusal of the question is always rewarded.

Section (a) part (iii) concerned the identity of the fuse; it was pleasing to see that nearly all the answers here were correct.

Part (iv) was about the function of the cable clamp, this was known by nearly all. Unfortunately, a few good but irrelevant descriptions of fuses were given.

In section (b) part (i) the transformer or step down transformer was known by most, very few blank scripts were seen here. “resistor” was the most common incorrect answer; “power pack” was not considered a component and a few offered “transistor” or “transducer”. This topic does not seem to be universally well covered.

In part (ii) the diode or rectifier was known by most – but this was not as accessible as (b) part (i). There were a few blanks. “Op-amp” was seen several times as the guess of choice.

Question 2

This system based question provides an accessible question that embodies the essence of the specification, a systems approach to electronics.

In section (a) parts (i) to (iv) these parts were attempted by nearly all and were high scoring. Of those few that got it wrong, it was common to mix up memory and ADC.

In section (b) parts (i) to (iv) this type of question proved accessible to many and these parts were again high scoring. Again the same confusion between memory and ADC was seen.

Section (c) parts (i) and ii) caused few problems. A few were tempted into giving ADC for producing an analogue signal.

Question 3

This simple logic question again led with the application, and worked its way to selection of a suitable gate as did last year’s question. This seems to be generating a higher level of response.

Section (a) parts (i) and (ii) were generally well answered. They were attempted by all – a few wrote in words of explanation instead of completing the truth table with ones and zeros.

Section (b) was attempted by nearly all and understood by most. A few referred to valves A and B and their meaning was not clear. Several thought that both valves should be in the same state – either closed or open, and consequently lost marks.

Section (c) was found to be mostly correct but there were a few examples for each type of gate suggested rather than the NOT gate required.

In Section (d) most named the NOT gate and could draw its symbol – but some were seen with two inputs and some circles (or negation bubbles) missing. A few lost marks because they forgot to label the inputs and outputs. A significant number gained error carried forward marks after naming the incorrect gate in 3(c) but drawing the correct symbol for their gate.

Question 4

The 555 timer question is obviously a favourite and has been well learned.

Section (a) part (i) is known by most – a very few astables and a very few blanks were seen. Candidates obviously know their astables from their monostables.

In part (ii) the pull up resistor confused some candidates who included it in the timing network however very many obtained full marks. Some who had completed the more complicated parts then went and lost a mark through omitting the ground connection. This diagram had generally been learnt well and some even added a switch to provide the input to the trigger.

In part (iii) very many gave "pull up" or a very good description. A few lost marks for "pull down". All candidates attempted this part and a considerable number who could not provide the correct response went along the lines of limiting current, setting the time or protecting the 555.

In part (iv) "go low" or "falling edge" was known by many – a few even mentioned $^1/_3V_s$. Nearly all attempted this and only a few gave "high".

In section (b) there were many correct and well-presented calculations. Many were less well presented but never the less resulted in a correct answer. Some lost track of powers of ten and as might be expected a significant number could not rearrange the equation.

Question 5

A chance for some calculations was presented here, addressing the issue of selecting a resistor to be connected in series with a power LED. The specification includes this and the currents in modern LEDs can reach over a magnitude greater than the typical 5mm through hole mounted components that have been around for years.

In section (a) part (i) most candidates scored two marks and the LED symbols were either good or at least recognizable. Most connected the LED in forward bias but reverse bias was not penalised on this occasion; it was the symbol that attracted the mark.

Part (ii) saw mostly good answers involving limiting current. There were some acceptable descriptions of dropping voltage. "Current across" and "voltage through" were only seen occasionally and not given credit.

On to the electrical calculations, section (b) part (i) saw many correct answers including a unit.

Part (ii) saw many correct answers with most handling the current in mA. Those capable of tackling this calculation had nearly always obtained the correct answer for (b) part (i) so the error carried forward marks were not awarded often.

In part (iii) more candidates benefited from the ecf marks here. Few chose a lower preferred value but those who did lost the mark.

In part (iv) many candidates were still following through the stages of the calculation and scoring full marks. There was less need for ecf marks here as those still going had usually obtained correct answers previously.

Part (v) was familiar to many and considerable benefit gained from ecf marks. Some candidates gave a colour code and scored zero here, it pays to read the question.

Question 6

This is a radio-oriented question, based on knowledge of an audio system and the types of modulated wave used in radio broadcasting.

In section (a) part (i) many gained 3 out of the 4 marks because they did not realise that the tuner and MP3 player should both be connected to the input of the amplifier. A small number did not attempt a system diagram but instead gave a flow chart or other diagram and consequently lost marks.

Part (ii) was not attempted by a significant number; maybe they overlooked the question at the bottom of the space on the paper. Some showed the microphone connected directly to the amplifier.

Section (b) part (i) saw a few “analogue”, “audio”, “amplifier”, and “modification” were seen but this was attempted by nearly all candidates and correct for most.

The FM wave in part (ii) was recognised by nearly everyone.

Part (iii) saw some very good diagrams. Often the best candidates had drawn a dotted line as the envelope of the waveform. Some lost marks as sloping spikes rather than sine wave shapes were drawn.

The final part, (iv), was attempted by nearly all and known by most candidates.

Question 7

The flow chart question, following a well-trodden path in this subject over at least the preceding two decades, a favourite amongst candidates every year.

Section (a) was high scoring. The output box was the most common mistake. A few candidates lost marks because they changed their answer and it was impossible to tell which they meant to be their final decision on the shape of the box. Candidates should not offer examiners a choice of answers, examiners will respond with their choice of marks.

In section (b) the process box was the most problematic but still high scoring. Some candidates omitted an output label as these boxes were not as obvious as the inputs in this question.

Section (c) was attempted by nearly all and there were some good concise answers – some were accurate but over complicated and repetitive. As usual it was fairly common for candidates to miss the input box before they gave a decision box. (e.g. “Is the charger connected?” without an “Input the state of the charger”. Some did not have a facility for checking whether the battery was fully charged – the loop was missing. Plenty of high marks were awarded nevertheless.

Question 8

A more searching question of the longer variety, ranging from power supplies through relay switching to the astable circuit. A chance for more able candidates to get to grips with something more substantial whilst still providing opportunities for the less able to score marks.

In section (a) part (i) all 3 components were known by many – the fuse was the best known. Some lost a mark for giving LED rather than diode and some did not recognize the transformer.

Part (ii) was known by many and drawn neatly. Several gave square waves and did not score and a few gave full wave rectification and were given one mark.

Answers to part (iii) seemed to be going in centres – familiar to some groups but not to others who made guesses.

In part (iv) a capacitor was added correctly by many but only a minority gave a polarised capacitor.

Section (b) was found challenging by many but there were still many correct answers. Many gained two of the three marks for minor errors. A significant number showed many connections randomly joining the two sides of the diagram suggesting little familiarity with relays.

Back to the 555 timer in section (c), in part (i) many neat accurate diagrams were seen. Missing the speaker or showing it with only one connection was common and lost a mark.

In part (ii) many correct answers with more able candidates keeping track of the powers of 10. As expected others struggled and gained only partial credit.

In part (iii) many gained error carried forward marks in calculating the frequency of the pulses here.

In part (iv) again there were many error carried forward marks. Very many candidates were familiar with the range of human hearing and answered accordingly. A few stated that the frequency was not ideal (and even suggested 2 kHz) and gained full credit.

Question 9

Another long searching question, this time involving logic in greater depth, going on to the operation of an op-amp as a comparator and interpretation of transducer characteristics.

Section (a) was challenging but many well drawn logic diagrams were seen.

Section (b) part (i) was known by most, but part (ii) proved more challenging. Competent candidates carried through to the final column and gained full marks. Others struggled earlier on and marks were lost.

In section (c) part (i) most gained both marks.

Many good answers were seen to part (ii); some candidates did not give the names of the inputs. Some went into long descriptions of how the LDR behaves in the circuit (sometimes missing out the detail of the op-amp).

Candidates should be aware that the space provided for an answer is an indication of how much is required.

Section (d) part (i) was known by nearly all but some lost the mark by not giving the unit.

Part (ii) was very well answered, it was attempted by just about everyone and there were very few errors.

Part (iii) was found difficult with many not giving a full justification of their value.

Question 10

This was a very wide ranging question, at the highest level. Elements of combinational and sequential logic were present, progressing through the use of the oscilloscope to a practical board layout, and even a colour code at the very end.

Section (a) was found challenging by many. Some candidates need to give more thought to the direction of arrows in system diagrams (although they were not penalised for this on this occasion). Some candidates showed the reset subsystem connected to more than one other subsystem and when candidates offer a choice of different answers they are inevitably penalised as noted earlier.

Section (b) was again challenging – some said “both switches because they are AND gates”. Many who correctly said B could not justify their choice or did not go as far as considering the effect on gate 2. Perhaps more space should have been given for this answer but the most able provided a full and concise answer on the dotted lines allocated.

In section (c) part (i) there were plenty of candidates with marks of 1, 2 and 3. Some placed the resistor in series with a switch between reset and ground (or reset and $+V_S$). Although some answers appeared to be random connections, nearly all candidates were still trying!

Part (ii) was again challenging and a common error was to take the connection from Q9 to the reset pin. A significant number did not attempt this part.

In section (d) part (i) only a few candidates left blanks. This was found difficult by many and it was hard to see the reasoning behind incorrect answers – apart from those who ended up with 0.06 s because they had used only half the waveform.

In part (ii) the word tolerance or a good description of what it means was required. Some ingenious answers – heating – resistance of the connecting wires - were not given credit. The oscilloscope being broken was given more commonly than inaccurately calibrated.

In section (e) part (i) some full answers were seen from the most able. Some omitted what happens when the switch is released- some others said the output would go low or go low after a time.

Part (ii) was answered neatly and accurately by many but a few seemed not to have seen prototyping board before and showed all their connections to the chip. Overlooking the connection to pin 6 was fairly common - the penalty of the loss of one mark was the same as that for misplacing a wire which shorted out the power supply.

The final section of this question, (f), attracted nearly all candidates despite its location at the end of the paper and many were rewarded with full marks.

Mark Ranges and Award of Grades

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

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Convert raw marks into Uniform Mark Scale (UMS) marks by using the link below.

UMS conversion calculator www.aqa.org.uk/umsconversion