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Electronics ELEC1

(Specification 2430)

Unit 1: Introductory Electronics

Report on the Examination

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General Comments

ELEC1, the Introductory Electronics paper is now well established and this year resulted in candidates gaining a wide spread of marks. The marks this year ranged from a minimum of two marks, with 22 candidates in total gaining marks in single figures, significantly less than last year's figure of 36. At the other end of the scale, three candidates scored 66 marks out of 67 (no-one scored the maximum), and a pleasing 58 candidates scored 60 or more marks, last year the figure was virtually half that figure at 30. The spread of marks was such that again this year there was no pronounced peak, but a wide plateau from the mid 50's down to the mid 20's where similar numbers of candidates gained each mark.

The content and level of this paper was again similar to that of the previous year, there were continuing attempts to make ELEC1 and ELEC2 equally accessible. The performance of candidates this year on ELEC1 at the high and low mark ranges was slightly increased which was reflected by the fewer number of candidates scoring very low marks and the effect, also noted above, on the most able candidates. It seems that the length of time allowed to answer the paper (one hour), was sufficient. All questions on the paper were again proved to be accessible to some candidates, since maximum scores for every question were noted although no single candidate managed to put this all together and make a maximum score for the complete paper, as noted earlier, three candidates got within a single mark of this goal. Judging by the spread of marks the accessibility of the paper was slightly higher this year overall, but this paper still provides stretch and challenge for all candidates.

Question 1

This year the format went back to previous practice of placing the simple logic question first. Candidates in the main appear to have been fairly well prepared for this type of question and a high level of success was noted here.

(a) The truth table entries were correctly completed by over 80% of all candidates. It was necessary to get each column correct in its entirety for each mark so this is quite an achievement.

(b) There were many good attempts at complex functions here, but some failed and did not even heed the instruction to restrict the answers to input variables only. Two thirds of candidates gained full credit here, which is worthy of note. Candidates should be encouraged to make full use of brackets when compiling a Boolean algebraic expression for the avoidance of doubt if nothing else.

(c) Over 80% of candidates correctly spotted the function of the whole circuit, even more than those who correctly wrote down the Boolean expressions so there must have been the sort of intuitive analysis going on here that is only common amongst those who are well practised in this topic.

Question 2

This year the systems question was restored to the second question in the paper. The question itself followed a format that was introduced several years ago, and continued this year by asking for the location of various components within the system.

(a) The response to drawing the diagram was good with over 75% of candidates getting half marks or more, this is a better response than last year. The main problem again was the same as last year where candidates were not able to give the extra detail in the area of the comparators; at this level they should be familiar with the need for a voltage divider to provide a reference voltage in the form of the "set level" subsystem. Very few picked up the reference to the low level of output from the microphone which then needed an amplifier. Similar problems were noted in locating the logic gate to gate the pulses from the astable. An improvement was noted where more candidates were able to locate a driver before the AWD.

(b) This section was well answered except for part (i) where only just over 10% of candidates were able to locate two places where an op-amp might be located, this was related to the previous section where the need for a microphone amplifier was not spotted. In part (ii), two-thirds knew where the potentiometer could be used and pleasingly nearly 90% could locate the MOSFET in part (iii).

Question 3

This question about the use of a potentiometer circuit contained requirements to calculate and select an appropriate component value, allowing for the power dissipation of the LDR. Responses to the early parts were generally good but tailed off in the middle of the question as it got more demanding, finally finishing with an improvement in the quality of answers as expected on the more general issues.

(a) In part (i) over 40% of candidates were able to show the correct current here, the key for the marks were to see a calculation resulting in 31.6mA, rather than simply manoeuvring figures around and magically coming up with "32". In part (ii) and (iii), nearly 60% were successful at calculating the total resistance, but then fewer than 35% were able to go on to give a valid resistance for R.

(b) This was the least well answered section in this question. It was only based on potential divider theory, but the mathematics involved eluded most, as did the esoteric difference between the output voltages at the two light levels. Part (ii) was even worse than part (i). This provided a challenge for those at the highest level.

(c) This section had a better response, since it must have been obvious to more candidates that the value of R was responsible for the low output voltage. Nearly 50% of candidates did well here.

(d) Related to the previous section, once the problem had been described, its solution became obvious to nearly 60% of candidates.

(e) Many could see the benefits for the low capacity battery of the resistance change and said so.

Question 4

This question with a topical Olympic theme focussed on an application of the op-amp as a comparator, its shortcomings, and the use of a MOSFET connected to it as an output transducer driver. Most sections were found difficult by many candidates.

(a) Most candidates were able to state that a temperature sensor was required, but fewer (just over a quarter) were able to detail a thermistor in a voltage divider circuit as was required for the two marks.

(b) This was the only really well answered section; even then only just over 60% got the mark for stating that a comparator circuit was required.

(c) The switching action of a comparator circuit is comparatively unknown; at least that is what is to be inferred from the fact that less than 20% of candidates could gain both marks here.

(d) Less than 40% of candidates could draw a simple comparator circuit that would match the requirements set out in the question.

(e) Saturation levels of an op-amp output signal are almost unknown territory here; just over 10% gained the mark here.

(f) Too many generalised answers and not enough technical detail was on offer from candidates here, it is not good enough to jump on the cost and availability bandwagon at every opportunity.

(g) This was added to the diagram in section (d) and achieved about the same response. There is no more basic requirement in this specification than to draw simple circuit sub systems.

Question 5

This question focussed on the requirement for a series resistor to be included with a LED, simple calculations and selection of a suitable component. It met with a better response overall.

(a) Almost three quarters of candidates scored both marks on this straightforward introduction to this question, drawing a simple series circuit comprising a LED and its series resistor.

(b) All the parts of this section were answered correctly by over 60% of candidates, power calculations, resistance calculations, selection of a preferred value and the subsequent colour code met a tolerable response.

Question 6

This final question as has been the custom before, returned to the topic of logic, which is heavily represented in the specification and so this must be reflected in the examination. The pattern is established now with a more accessible question earlier on in the paper, followed by a more challenging question at, or near, the end of the paper. This year's question went from the meaning of logic levels and how to generate them, to Boolean algebra as preparations for drawing a logic diagram that would perform the required function.

Finally, simplification of the logic circuit was examined. All but the final section met with a response in the 50% to 60% range, the extension work at the very end was meant to be challenging and proved to be so, only just over 20% of candidates were up to this.

(a) In part (i) only nearly 60% of candidates could adequately state the meaning of logic 1 in a logic system. Again in part (ii), the requirement here was for some very simple circuit diagram drawing, involving a resistor and a switch. This was answered correctly by just over half of all candidates.

(b) The response here to the requirement to convert a written description of the operation of the system into Boolean Algebraic expressions was a little better at over 60% gaining all three marks.

(c) A good response was noted here. Over 65% of candidates could draw the logic diagram and obtain full marks.

(d) Less than one candidate in four gained all three marks here, but this was a demanding question aimed at the most able, and those with the time to complete it in what must have been for them, a busy hour.

Most candidates again this year completed their answers to this paper and indeed most of them attempted final question indicating that there was sufficient time to complete this years' paper in the allotted hour.

Mark Ranges and Award of Grades

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