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General Certificate of Education

Electronics 1431/2431

ELEC5 Communications Systems

Report on the Examination

2010 examination - June series

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General Comments

The content of this paper was broadly similar to the previous specification, given the addition of the audio systems section, previously part of the legacy AS specification, and some updating of other content. The length of time allowed to answer the paper remains as before at one hour and a half. It was expected that given this small change in content and the small change in mark total (from 72 previously to 80 now), that performance on this paper would be broadly similar to its predecessor.

All questions on the paper proved accessible to some candidates, since maximum scores for every section were noted. However no candidates managed a perfect response to the complete paper, so this was a challenging paper even for the most able candidates. Candidates at the lower end of the scale had plenty they could respond to as evidenced by the fact that so few achieved less than 25% of the marks available. The complete nature of candidates' answers to the questions, particularly the last question, demonstrated that there was adequate time for the paper to be completed despite the increase in the number of marking points to be met.

Question 1

This first question on part of a generalised communications system was intended to be an accessible question to provide all candidates with an opportunity to make a positive start to the paper. This was more successful in section (a) than in section (b).

(a) The labelled block diagram was completed successfully by the vast majority of candidates. Where mistakes were made was centred on not having the modulator as the central part of the system, and a linear arrangement being offered.

(b) Marks were lost here by candidates who did not read the question. It stated clearly that the action on the input signal or signals, and the form taken by the output signal was required; it pays to read the question carefully. Most candidates missed the fact that the carrier generator has no signal input, and the function of the input transducer is not well known. Many candidates could get at least two marks in answer to the operation of the modulator, and the operation of the transmitter was the best answered amongst these parts of the question.

Question 2

This question was concerned with the properties, problems and operation of optical fibres used in optical communications.

(a) Candidates were asked to draw a ray of light travelling along a curved section of step-index fibre; most managed the ray of light travelling from one total internal reflection to the next. A few candidates forgot this was to be along a curved fibre, some very late bends were noted, added as an afterthought. Candidates commonly failed to gain credit in the drawing and labelling the structure of the fibre and incorrectly labelling the areas of low and high refractive index. The written answer below should have focussed on the total internal reflection and the condition with regard to the critical angle, this part was not well answered.

(b) This section was poorly answered, most candidates are not aware of the correct meaning of dispersion in this context and its effect on a signal.

(c) Many candidates were aware of the effects of attenuation and radiation, but were not able to explain adequately the causes of these phenomena.

(d) This section enabled most candidates to complete this question in a positive way, the advantages of optical fibres over wired systems are well known. It is worthwhile to note that the question was carefully read by most candidates who kept within the technical remit here.

Question 3

This question on the operation of the superhet radio receiver was well answered on the whole.

(a) The vast majority of candidates were able to gain at least half marks here, nearly a quarter of them gaining all six marks. Where there were problems it seemed that there was as much difficulty in expression of ideas rather than in knowledge of the concepts involved.

It is a good idea to get future candidates not to use words from the question in their answer, e.g. Question; “what does an amplifier do?” Answer often seen; “it amplifies the signal”. Better to write “it increases the amplitude of the signal”, or simply “it boosts the signal”.

(b) This part was very well answered indeed, nearly 90% of candidates could calculate the two new frequencies generated by the mixer, which of these frequencies was the intermediate frequency was less well answered, but still by nearly 70%. As expected the final part proved too difficult for all but the most able candidates. Very few candidates were able to calculate the second channel or image frequency.

Question 4

Inclusion of synoptic material from ELEC2 in the form of a 555 monostable circuit was addressed in this question in relation to the generation of a Pulse Width Modulation (PWM) signal.

(a) Nearly 90% of candidates could state what PWM stands for, but only two-thirds could correctly describe how an analogue information signal is encoded to produce a PWM signal.

(b) Completing and labelling the 555 timer circuit had a varied response, over half of all candidates managed to score at least half marks here. Most candidates were familiar with the location of the timing components. The least well answered part was to label where the analogue information should be connected.

(c) Over two-thirds of all candidates completed the calculation of the timing resistor correctly and scored both marks here. Of the remaining one-third, a popular error was to calculate the time constant from the general formula rather than use the appropriate 555 formula on the data sheet.

Question 5

This question based initially on an application of a tuned circuit, going on to data transfer, met with a mixed response.

(a) Two-thirds of all candidates managed to show they could calculate the required value for the inductor, either by rearranging the resonance equation and solving for L, which gave 918nH, or by working through the equation using the 920nH to give a frequency slightly below the value of 13.56MHz. Credit was not gained when there was no evidence of a calculation.

The sketch of the frequency response curve was very well answered. In the next part the terms selectivity and quality factor were known collectively by just under half of all candidates, with quality factor receiving the poorer responses.

(b) Very few (just over 10%) candidates could completely explain half-duplex communication. To offer just one way communication was only enough for a single mark, but even this was only given by just over half who attempted it.

(c) This calculation of the time it would take to read all the data from the tag proved too difficult for the majority of candidates, a mere 10% gained both marks. Several totally unrealistic answers should have been recognised and the calculation re-worked.

Question 6

This question focussed on new content in this specification, Digital Audio Broadcasting (DAB), along with some traditional content on wavelength and frequency. The general quality of responses was poor.

(a) Less than 40% of all candidates were able to give a clear correct response here, even “VHF/UHF” was given credit, but “FM” and “medium wave” were seen too often.

(b) Nearly half of all candidates were able to do a simple arithmetic calculation to show that the multiplex bandwidth could be accommodated.

(c) 40% of all candidates arrived at the correct answer here. Other candidates should have realised the impracticability of their answer and tried again. There seems to be no concept that VHF wavelengths ranged from a few metres down to one metre. Answers seen ranged from less than the diameter of a neutron up to the diameter of our galaxy.

(d) Some good written answers were seen on this part. About half the responses gained two or more marks. Possible marking points centred around the speech/music, stereo/mono, high quality music/pop, and extra data issues.

(e) Very few candidates could do this calculation; a common error was to omit the factor of two for the stereo nature of the signal. Candidates who did this were still awarded one mark.

Question 7

This question partly represented synoptic content whilst drawing mostly from the new section on audio systems in this new specification.

(a) The breakpoint calculation was one of the better answered parts, being gained by almost 60% of all candidates, nearly all of which went on to choose a suitable resistor value and correctly state the effect of their choice on the breakpoint frequency.

(b) The reactance calculation was the highest scoring part here, a sizeable number of candidates then slipped up in choosing a suitable value for the resistor despite the earlier section. Parts (iv) and (v) were poorly answered.

(c) This last section of the last question on the paper was attempted by many, but credit gained only by a tiny majority of candidates. Saturation was often incorrectly quoted instead of the lack of a DC feedback path leading to drift. Just over 5% of all candidates knew this.

Most candidates completed the paper and indeed most of the final question indicating that there was sufficient time to complete this years' paper in the allotted time.

Mark Ranges and Award of Grades

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