GCE MARKING SCHEME

SUMMER 2019

ELECTRONICS - ET4 (LEGACY)
1144/01

INTRODUCTION

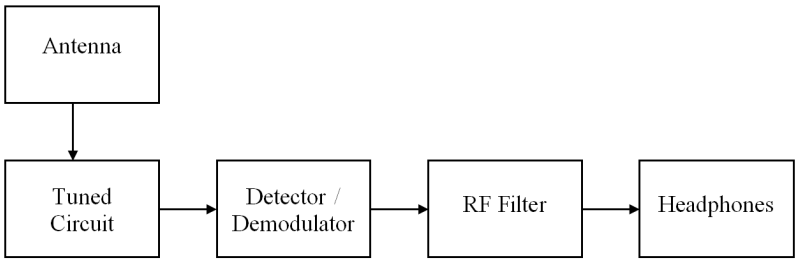
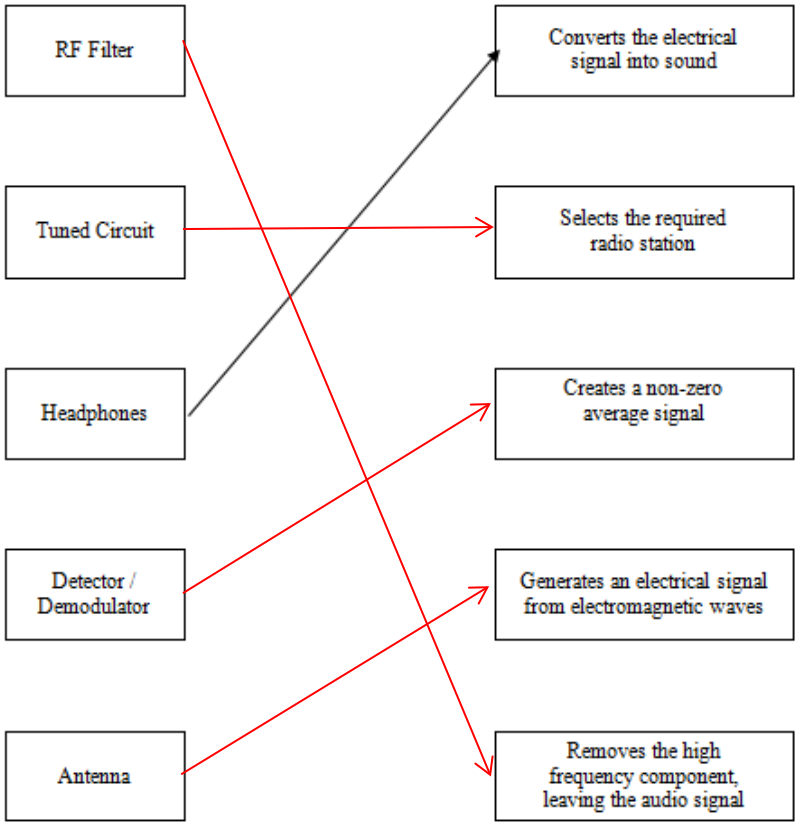
This marking scheme was used by WJEC for the 2019 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

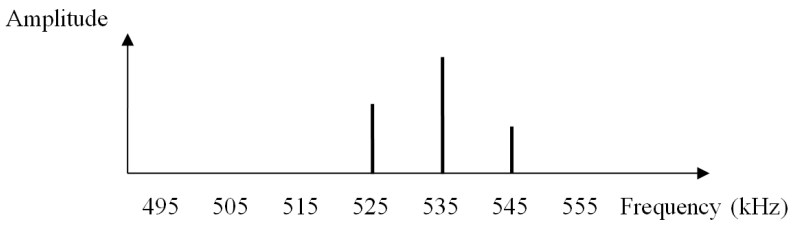
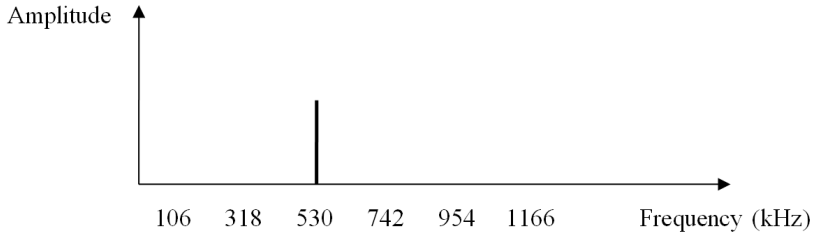
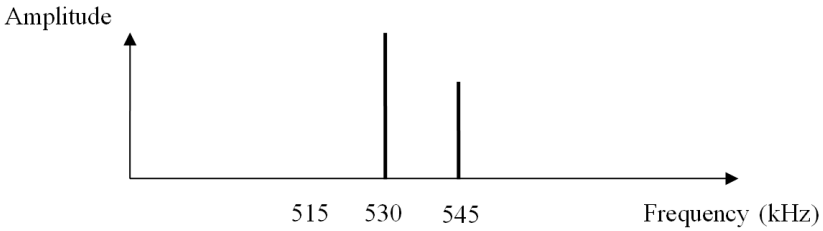
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

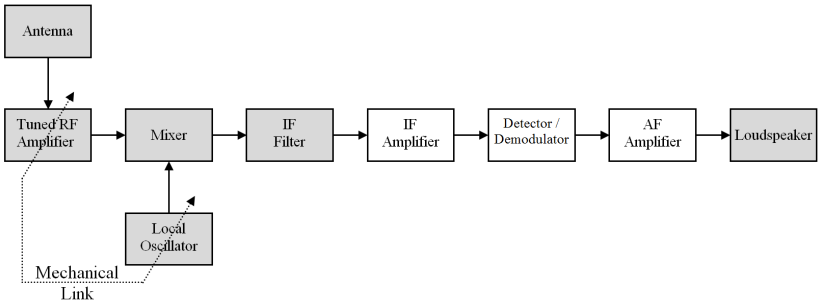
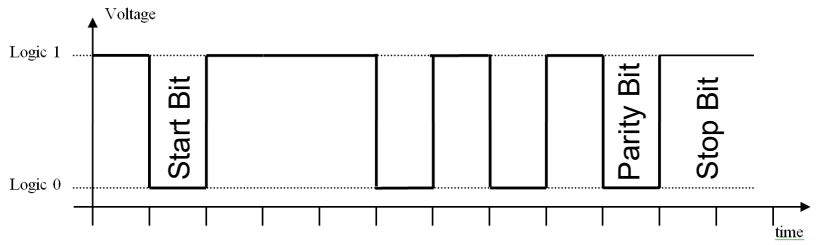
WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

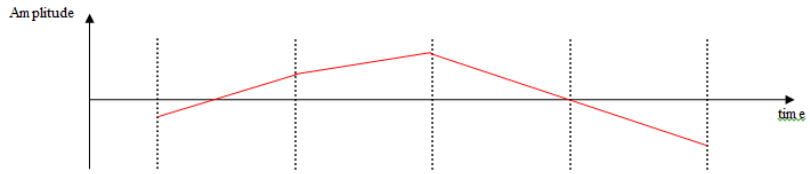
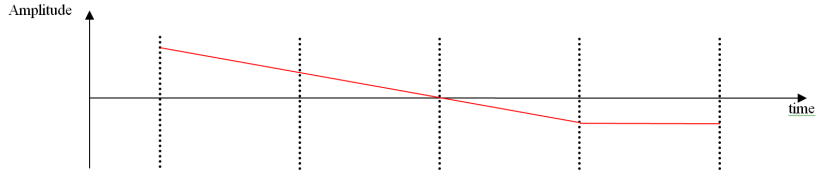
GCE ELECTRONICS - ET4

SUMMER 2019 MARK SCHEME

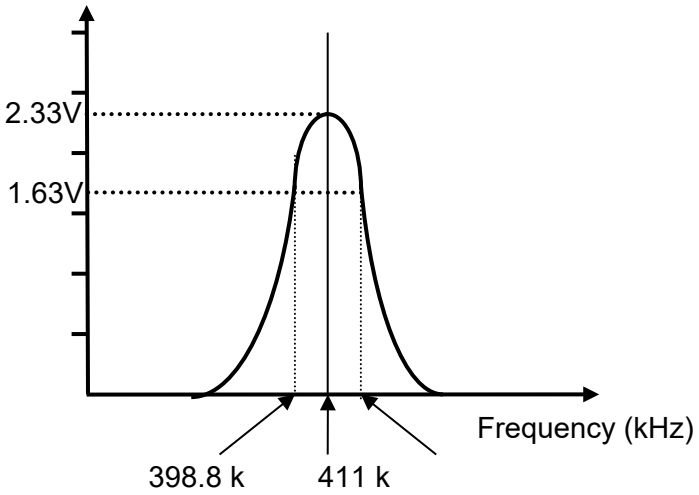
Question			Marking details	Marks Available
1.	*(a)*			1
	(b)			4 Correct = 2 marks 2 correct = 1 mark **[3]**

Question			Marking details	Marks Available
2.	*(a)*			1
	(b)			1
	(c)			1
				[3]

Question			Marking details	Marks Available
3.	*(a)*	(i)	1.680MHz, 2.140MHz, 3.820MHz, 0.460MHz (460kHz)	4 correct = 2 3 correct = 1
		(ii)	0.460MHz (460kHz)	1
	(b)			3
	(c)	(i)	$\beta = \frac{\Delta f_c}{f_i} = \frac{100}{20} = 5$	1
		(ii)	Bandwidth $= 2(\Delta f_c + f_i) = 2(100 + 20) = 240$kHz or Bandwidth $= 2(1+\beta)f_i = 2(1+5)20 = 240$kHz	1 (number) 1 (unit) **[9]**
4.	*(a)*	(i)	The Parity Bit is a simple form of error checking. (any reference to error correction = 0)	1
		(ii)	Logic 1	1
	(b)	(i)	 1 mark for each correct label	3
		(ii)	Character transmitted = “W”	1
	(c)	(i)	There are still an odd number of 1’s so the simple parity bit will pass.	1
		(ii)	Reference to more parity bits being used to check smaller groups of bits = 1	1 **[8]**

Question			Marking details	Marks Available
5.	*(a)*	(i)	Pulse Amplitude Modulation.	1
		(ii)		1 (shape) 1 (accuracy)
	(b)	(i)	Pulse Width Modulation	1
		(ii)		1 (shape) 1 (accuracy)
	(c)		No of levels required = $\frac{5}{200\times10^{-6}} = 25000$	1
			14 bits provide 2^{14} = 16 384 levels, 15 bits provide 2^{15} = 32 768 levels, so 15 bits would be suitable.	1 **[8]**

Question			Marking details	Marks Available
6.	*(a)*		$\frac{10 - V_{\text{IN}}}{8} = \frac{10 - 1}{6.8}$ $10 - V_{\text{IN}} = \frac{8 \times 9}{6.8}$ $10 - V_{\text{IN}} = 10.59$ $V_{\text{IN}} = 10 - 10.59 = -0.59\ \text{V}$ correct formula / substitution or use of ratio correct answer *{If candidates attempt a voltage divider solution award 1 mark for correctly labelled diagram, 1 mark for correct numerical answer}*	 1 1
	(b)		$\frac{-10 - V_{\text{IN}}}{8} = \frac{-10 - 1}{6.8}$ $-10 - V_{\text{IN}} = \frac{8 \times -11}{6.8}$ $-10 - V_{\text{IN}} = -12.94$ $V_{\text{IN}} = -10 + 12.94 = 2.94\ \text{V}$ correct formula / substitution or use of ratio correct answer *{If candidates attempt a voltage divider solution award 1 mark for correctly labelled diagram, 1 mark for correct numerical answer}*	 1 1
	(c)		Regeneration of a digital signal after transmission.	1
				[5]

Question			Marking details	Marks Available
7.	*(a)*		$f_o = \frac{1}{2\pi\sqrt{LC}} = \frac{1}{2\pi\sqrt{0.015 \times 10^{-3} \times 10 \times 10^{-9}}}$ $= 410\,936 \text{ Hz} \cong 411 \text{ kHz}$ multipliers answer	 1 1
	(b)		$R_D = \frac{L}{r_L C} = \frac{0.015 \times 10^{-3}}{2.3 \times 10 \times 10^{-9}} = 652.17\ \Omega \cong 652\Omega$ correct substitution in correct formula answer	 1 1
	(c)		$V_{\text{OUT}} = \frac{12 \times 652}{2700 + 652} = 2.33 \text{ V}$ Substitution in formula answer	 1 1
	(d)		$Q = \frac{2\pi f_o L}{r_L} = \frac{2\pi \times 410936 \times 0.015 \times 10^{-3}}{2.3} = 16.84$ Substitution in formula Answer	 1 1
	(e)		$bandwidth = \frac{f_0}{Q} = \frac{410936}{16.84} = 24402Hz \approx 24.4 \text{ kHz}$ Substitution in formula answer only	 1 1
	(f)		 • Shape (1) • Correct frequencies marked (1) • Peak output voltage 2.33 V (1) • Use of 0.7 x peak to plot bandwidth (1)	 4 **[14]**