GCE MARKING SCHEME

SUMMER 2018

GCE (LEGACY)
ELECTRONICS - ET4
1144/1

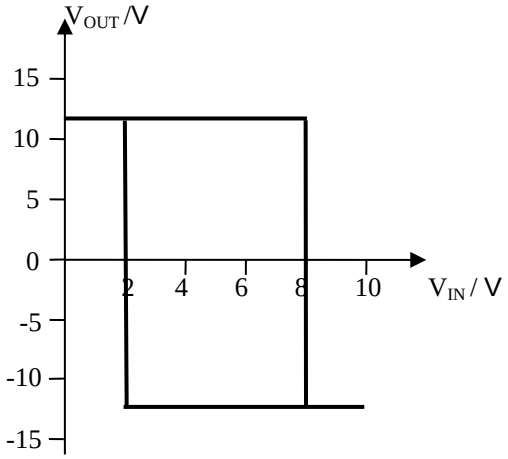
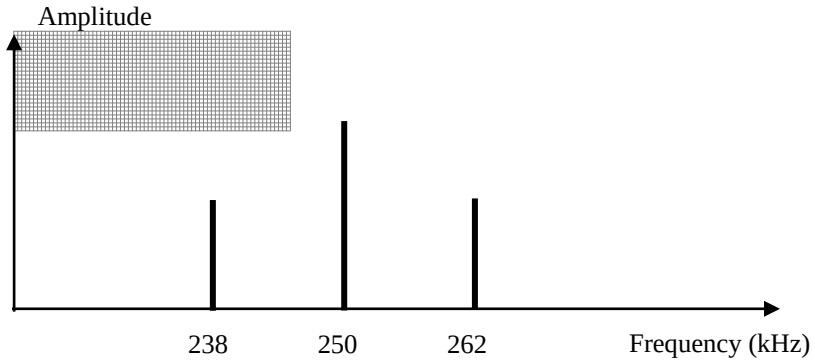
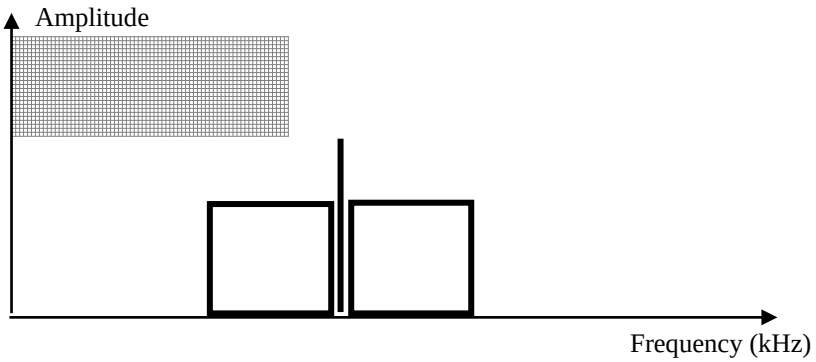
INTRODUCTION

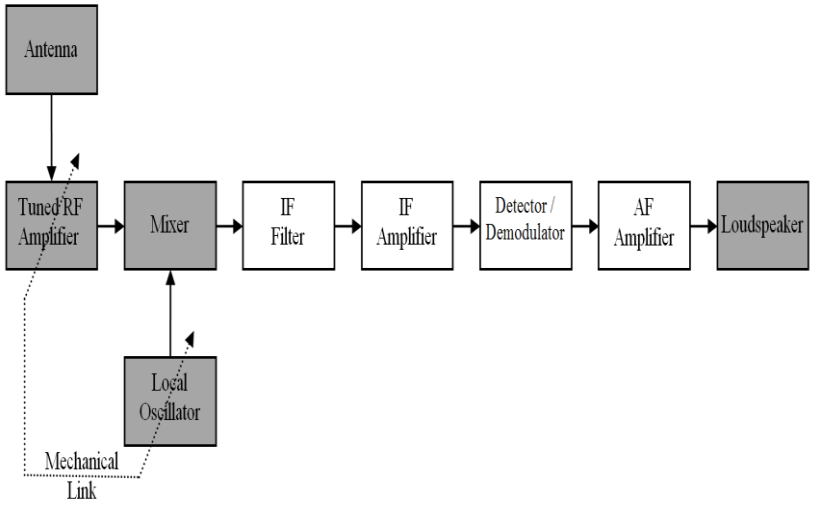
This marking scheme was used by WJEC for the 2018 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' 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.

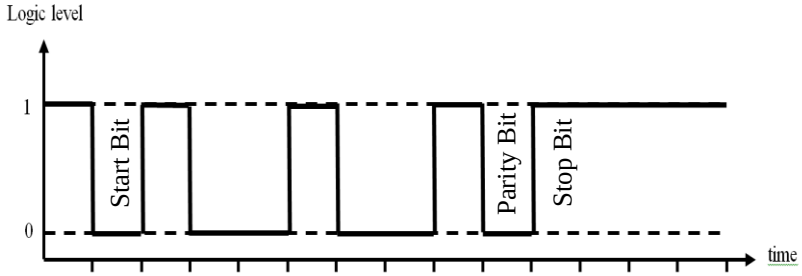
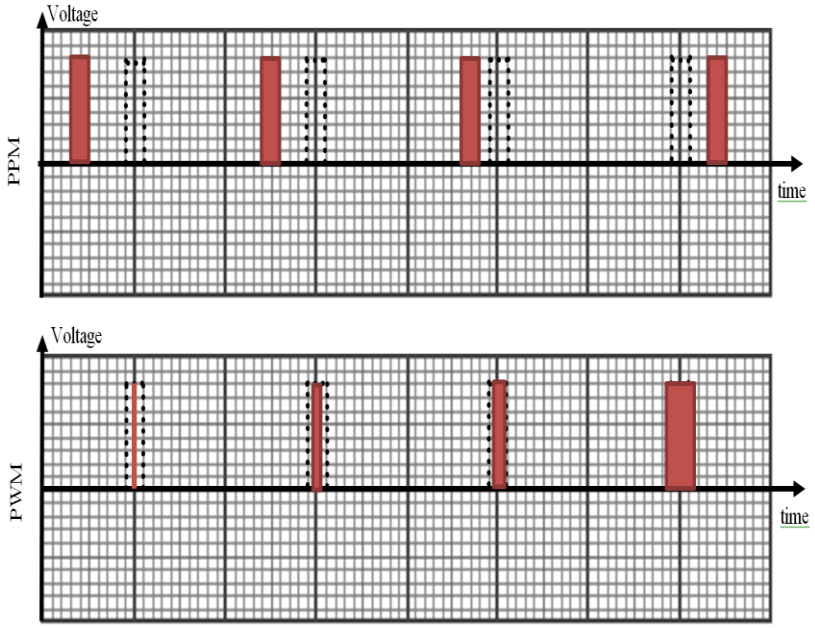
It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

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

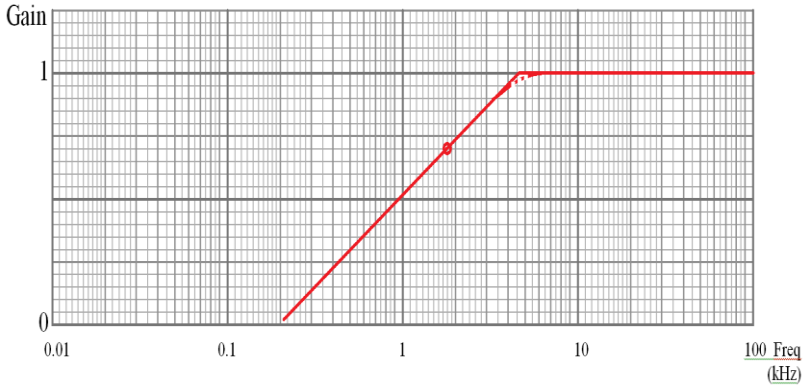
GCE (LEGACY)
ELECTRONICS - ET4
SUMMER 2018 MARK SCHEME

Question			Marking details	Marks Available
1	*(a)*		Inverting	1
	(b)			
			Saturation Levels at ± 12 V	1
			Switching thresholds at 2 V and 8 V	1
			Inverting characteristic (ecf from (a))	1
				[4]
2	*(a)*			
			Line spectrum	1
			Correct carrier frequency	1
			Correct side band frequencies	1
	(b)	(i)		
			Continuous Band spectrum	1
		(ii)	34 kHz	1

Question			Marking details	Marks Available
2.	*(c)*	(i)	$f_i = \frac{1}{80\times10^{-6}} = 12500 \text{ Hz} = 12.5 \text{ kHz } (\pm 0.5 \text{ kHz})$ or $f_i = \frac{1}{100\times10^{-6}} = 10000 \text{ Hz} = 10 \text{ kHz } (\pm 0.5 \text{ kHz})$	1
		(ii)	14 cycles in 80 µS = 5.71 µS $f_c = \frac{1}{5.71 \times 10^{-6}} = 175000 \text{ Hz} = 175 \text{ kHz } (\pm 5 \text{ kHz})$ or 14 cycles in 100 µS = 7.14 µS $f_c = \frac{1}{7.14 \times 10^{-6}} = 140000 \text{ Hz} = 140 \text{ kHz } (\pm 5 \text{ kHz})$	1
		(iii)	Modulation Depth $= \frac{V_{\max} - V_{\min}}{V_{\max} + V_{\min}} \times 100\%$ $= \frac{2 - 0.3}{2 + 0.3} \times 100\% = 73.91\% \ (Accept\ Range\ 70 - 76\%)$ or $= \frac{4 - 0.6}{4 + 0.6} \times 100\% = 73.91\% \ (Accept\ Range\ 70 - 76\%)$	1 **[8]**
3.	*(a)*	(i)	Z	1
		(ii)	V (W or Y)	1
		(iii)	W & Y	1
		(iv)	X	1
	(b)	(i)		4
		(ii)	I. IF Strip – (IF Filter / IF Amplifier) II. Tuned RF Amplifier.	1 1
		(iii)	1.430 MHz / 1.885 MHz / 3.315 MHz / 0.455 MHz or 455 kHz All 4 Correct = 2 marks 3 Correct = 1 mark	2
		(iv)	0.455 MHz or 455 kHz	1 **[13]**

Question			Marking details	Marks Available
4.	*(a)*	(i)	 1 mark for each correct label	3 1
		(ii)	Character transmitted = "I"	
	(b)	(i)	<table><tr><td>P_4</td><td>P_3</td><td>P_2</td><td>P_1</td><td>P_0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td></tr></table> All five correct = 2 marks All five inverted = 1 mark	2
		(ii)	(I) P_1, P_2 and P_3 fail the parity check (II) P_1, P_2 and P_3 fail the parity check – common to D_5, so this is where the error is. <table><tr><td>D_7</td><td>D_6</td><td>D_5</td><td>D_4</td><td>D_3</td><td>D_2</td><td>D_1</td><td>D_0</td><td>P_4</td><td>P_3</td><td>P_2</td><td>P_1</td><td>P_0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>0</td><td>0</td><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td></tr></table>	1 1 **[8]**
5.	*(a)*		 Correct Method in each case (2 x 1) Consistent Application in each case (2 x 1)	1 1 1 1

Question			Marking details	Marks Available
	(b)		No of levels required = $\frac{6}{300\times10^{-6}} = 20{,}000$ 14 bits provide, 2^{14} = 16 384 levels, 15 bits provide 2^{15} = 32768 levels so 15 bits would be suitable.	1 1 **[6]**
6.	*(a)*		$\frac{14 - V_{\text{IN}}}{9} = \frac{14 - 2}{7.2}$ $14 - V_{\text{IN}} = \frac{9 \times 12}{7.2}$ $14 - V_{\text{IN}} = 15$ $V_{\text{IN}} = 14 - 15 = -1\ \text{V}$ 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)		$\frac{-14 - V_{\text{IN}}}{9} = \frac{-14 - 2}{7.2}$ $-14 - V_{\text{IN}} = \frac{9 \times -16}{7.2}$ $-14 - V_{\text{IN}} = -20$ $V_{\text{IN}} = -14 + 20 = 6\ \text{V}$ 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 [**4**]

Question			Marking details	Marks Available
7.	*(a)*		$X_C = \frac{1}{2\pi fC}$ $= \frac{1}{2\pi \times 400 \times 18 \times 10^{-9}}$ $= 22.1048\text{k}\Omega \cong 22.1\text{k}\Omega$	
			substitution **and** multipliers = 1	1
			correct answer = 1	1
	(b)		0.221kΩ (221Ω) or (a) ÷ 100.	1
	(c)		$f_b = \frac{1}{2\pi RC}$ $f_b = \frac{1}{2 \times \pi \times 5000 \times 18 \times 10^{-9}}$ $f_b = 1.768\text{kHz}$	
			substitution **and** multipliers = 1	1
			correct answer = 1	1
	(d)			
			Shape for this high pass filter	1
			Break frequency consistent at 70% point with (c) (1.768kHz)	1
				[8]