



GCE A LEVEL MARKING SCHEME

SUMMER 2025

**A LEVEL
ELECTRONICS – COMPONENT 1
A490U10-1**

About this marking scheme

The purpose of this marking scheme is to provide teachers, learners, and other interested parties, with an understanding of the assessment criteria used to assess this specific assessment.

This marking scheme reflects the criteria by which this assessment was marked in a live series and was finalised following detailed discussion at an examiners' conference. A team of qualified examiners were trained specifically in the application of this marking scheme. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners. It may not be possible, or appropriate, to capture every variation that a candidate may present in their responses within this marking scheme. However, during the training conference, examiners were guided in using their professional judgement to credit alternative valid responses as instructed by the document, and through reviewing exemplar responses.

Without the benefit of participation in the examiners' conference, teachers, learners and other users, may have different views on certain matters of detail or interpretation. Therefore, it is strongly recommended that this marking scheme is used alongside other guidance, such as published exemplar materials or Guidance for Teaching. This marking scheme is final and will not be changed, unless in the event that a clear error is identified, as it reflects the criteria used to assess candidate responses during the live series.

EDUQAS A LEVEL ELECTRONICS – COMPONENT 1

PRINCIPLES OF ELECTRONICS

SUMMER 2025 MARK SCHEME

GENERAL INSTRUCTIONS

Recording of marks

Examiners must mark in red ink.

One tick must equate to one mark (except for the extended response question).

Question totals should be written in the box at the end of the question.

Question totals should be entered onto the grid on the front cover and these should be added to give the script total for each candidate.

Marking rules

All work should be seen to have been marked.

Marking schemes will indicate when explicit working is deemed to be a necessary part of a correct answer.

Crossed out responses not replaced should be marked.

Credit will be given for correct and relevant alternative responses which are not recorded in the mark scheme.

Extended response question

A level of response mark scheme is used. Before applying the mark scheme please read through the whole answer from start to finish. Firstly, decide which level descriptor matches best with the candidate's response: remember that you should be considering the overall quality of the response. Then decide which mark to award within the level. Award the higher mark in the level if there is a good match with both the content statements and the communication statement.

Marking abbreviations

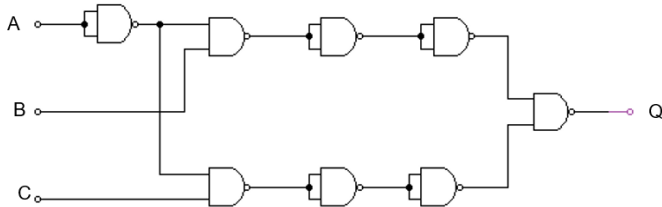
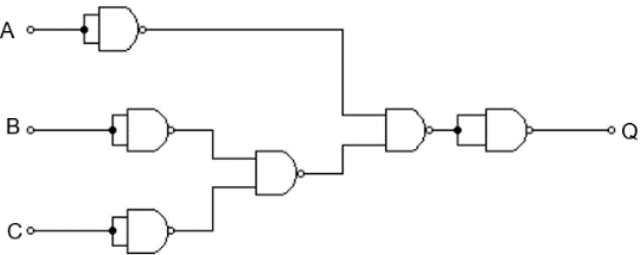
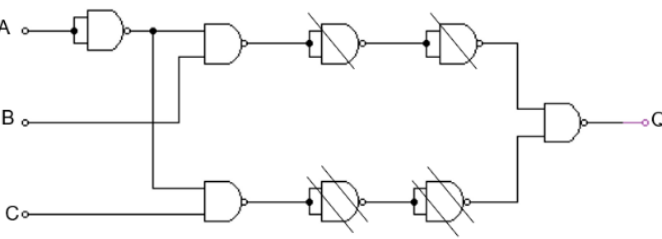
The following may be used in marking schemes or in the marking of scripts to indicate reasons for the marks awarded.

cao = correct answer only

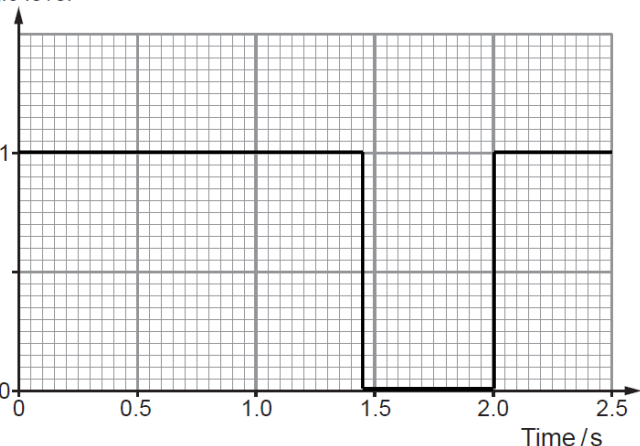
ecf = error carried forward

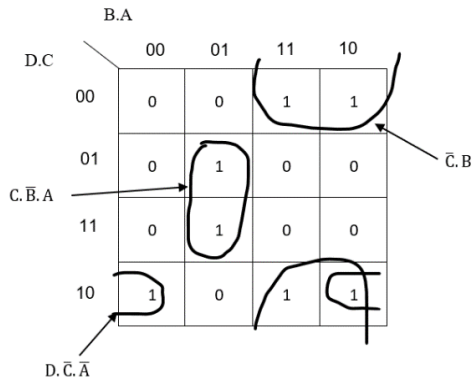
Question			Marking details	Marks available																																								
				AO1	AO2	AO3	Total	Maths																																				
1	(a)		XOR (1) (Accept EXOR)	1			1																																					
	(b)		<table><thead><tr><th>C</th><th>B</th><th>A</th><th>Q</th></tr></thead><tbody><tr><td>0</td><td>0</td><td>0</td><td>1</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td></tr><tr><td>0</td><td>1</td><td>0</td><td>0</td></tr><tr><td>0</td><td>1</td><td>1</td><td>0</td></tr><tr><td>1</td><td>0</td><td>0</td><td>0</td></tr><tr><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>1</td><td>1</td><td>0</td><td>0</td></tr><tr><td>1</td><td>1</td><td>1</td><td>0</td></tr></tbody></table> Q correct (1)	C	B	A	Q	0	0	0	1	0	0	1	0	0	1	0	0	0	1	1	0	1	0	0	0	1	0	1	0	1	1	0	0	1	1	1	0	1			1	
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	(c)	(i)	OR (1)	1			1																																					
		(ii)	Logic level A 0 1 Time → 1 0 B 0 1 Time → 1 0 C 0 1 Time → 1 0 Q 0 1 Time → 1 0 Q all correct (3) (-1 for each error)																																									
			Question 1 total	3	3		6																																					

Question			Marking details	Marks available																			
				AO1	AO2	AO3	Total	Maths															
2	(a)	(i)	Correct working (1) $X = A.B + \bar{A}.\bar{B}$ (1) Accept $\overline{A \oplus B}$ BA C ↙ 0 1 <table><tr><td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr><tr><td>0</td><td>1</td><td>-</td><td>1</td><td>-</td></tr><tr><td>1</td><td>1</td><td>-</td><td>1</td><td>-</td></tr></table>		00	01	11	10	0	1	-	1	-	1	1	-	1	-		2		2	1
	00	01	11	10																			
0	1	-	1	-																			
1	1	-	1	-																			
		(ii)	Correct working (1) $Y = A.\bar{C}$ (1) BA C ↙ 0 1 <table><tr><td></td><td>00</td><td>01</td><td>11</td><td>10</td></tr><tr><td>0</td><td>-</td><td>1</td><td>1</td><td>-</td></tr><tr><td>1</td><td>-</td><td>-</td><td>-</td><td>-</td></tr></table>		00	01	11	10	0	-	1	1	-	1	-	-	-	-		2		2	
	00	01	11	10																			
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1	-	-	-	-																			
		(iii)	A ○ ○																				

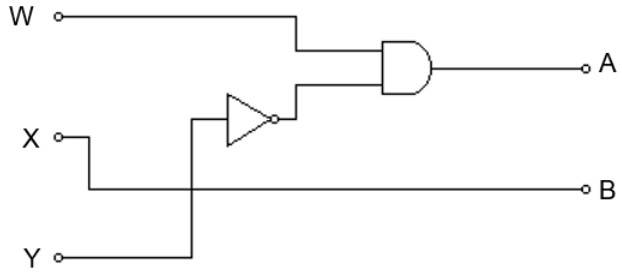
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(iv)	 AND gate correct (1) OR gate correct (1) Whole circuit correct (1) ecf from (iii) Accept alternative answer: 	2	1		3	
		(v)	 Per pair correctly cancelled (1) x2		2		2	

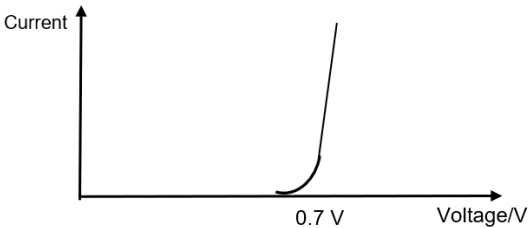
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)	(i)	$f = \frac{1.44}{(R_1 + 2R_2)C}$ $C = \frac{1.44}{(R_1 + 2R_2)f} = C = \frac{1.44}{(15 \times 10^3 + 2 \times 10 \times 10^3) \times 0.5} = 82 \times 10^{-6} \text{ or } 82 \mu\text{F}$ Select equation and rearrange (1) (correct substitution and powers) (1) Answer (1)	1	2		3	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	MS ratio = $\frac{R_1 + R_2}{R_2} = \frac{15 + 10}{10}$ (1) = 2.5 (1) $T = \frac{1}{f} = \frac{1}{0.5} = 2 \text{ s}$ So $t_H = 1.43 \text{ s}$ and $t_L = 0.571 \text{ s}$ (or plotted on graph) (1) Or $t_H = 0.7 (R_1 + R_2)C = 0.7(15 \times 10^3 + 10 \times 10^3) \times 82 \times 10^{-6}$ (1) = 1.435 s (accept: 1.44 s) (1) $t_L = 0.7 R_2 C = 0.7 \times 10 \times 10^3 \times 82 \times 10^{-6} = 0.574 \text{ s}$ (1) Logic level  Mark or space length correctly drawn (ecf) (1) Whole cycle correct (must show return at 2 s) (1)	1	4		5	2
			Question 2 total	4	15	1	20	6

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
3	(a)	(i)	A (1)	1			1	
		(ii)	B (1)	1			1	
		(iii)	B (1)	1			1	
	(b)		$\overline{A}.\overline{B}.\overline{C}.\overline{B}$ (1) $(\overline{A} + B).C.B$ (1) $(\overline{A}.C.B) + B.C.B$ (1) $(\overline{A}.C.B) + B.C$ $(\overline{A} + 1).C.B$ (1) $C.B$ (1)		5		5	5
	(c)		 Minimum and simplest number of groups identified on map (1) One group correctly labelled (allow ecf) (1) All terms correct (ecf) (1) $Q = \overline{C}.B + C.\overline{B}.A + D.\overline{C}.\overline{A}$ (1)		4		4	
Question 3 total				3	9		12	5

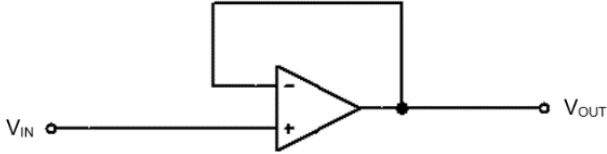
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
4	(a)		40 kΩ (1) Accept 39 – 41 kΩ	1			1	1
	(b)		$V_{\text{REF}} = \frac{14}{14 + 10} \times 12 = 7 \text{ V (1)}$ $7 = \frac{75}{75 + R_{\text{TH}}} \times 12 \text{ (1)}$ $7 (75 + R_{\text{TH}}) = 75 \times 12 \text{ (1)}$ $R_{\text{TH}} = \frac{900 - 525}{7} = 54 \text{ kΩ (1)}$ (Alternative method by ratios) From graph T = 10°C (1) Accept 9 – 11°C		5		5	5
			Question 4 total	1	5		6	6

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
5	(a)	(i)	$V_P = 1.25 \text{ V}, \quad V_Q = 2.50 \text{ V}, \quad V_R = 3.75 \text{ V}$ Step size (V_P) (1) All correct (1)	2			2	1
		(ii)	Overflow indicator OWTTE (1)	1			1	
		(iii)	Resolution = $\frac{\text{i/p voltage range}}{2^n} = \frac{5}{2^2} \text{ (1)}$ = 1.25 V (1)	1	1		2	1
	(b)		$A = W \cdot \bar{Y} \text{ (1)}$ $B = X \text{ (1)}$ (no other answer acceptable)  Circuit for A correct (1) Circuit for B correct (1) (allow ecf from A and B)		2	2	4	
			Question 5 total	4	3	2	9	2

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
6	(a)		 Shape (1) Graph rises sharply at 0.7V (1)	2			2	
	(b)	(i)	Gradient of straight line = g_M (1) Gradient = $\frac{3 - 0}{3.4 - 3.0}$ (1) = 7.5 S (1) Allow range of 6.5 to 8 S OR Using equation $g_M = \frac{I_D}{V_{GS} - 3} = \frac{3}{3.4 - 3}$ Substitution of values into correct equation (1) Rearrangement (1) =7.5 S (1)	1	2		3	2

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	$I_D = g_M (V_{GS} - 3)$ $I_D = 5.5(3.8 - 3) \text{ (1)}$ $= 4.4 \text{ A (1)}$ $P = I_D^2 r_{DSon} = 4.4^2 \text{ (ecf) } \times 0.2 \text{ (1)}$ $= 3.87 \text{ W (1)}$		4		4	4
			Question 6 total	3	6		9	6

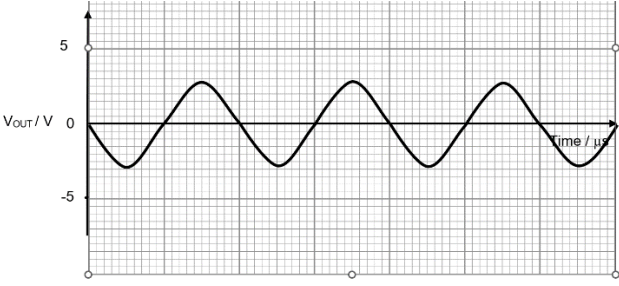
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
7	(a)	(i)	Resonant frequency = 3.8 kHz (1) Accept 3.7 to 3.9kHz (i.e. $\pm \frac{1}{2}$ small square) V_{OUT} at bandwidth = $0.7 \times 3 = 2.1$ V (1) Bandwidth = $4.8 - 2.8 = 2$ kHz (1) Accept 1.8 to 2.2kHz (i.e. ± 1 small square) $Q = \frac{f_0}{\text{bandwidth}} = \frac{3.8 \text{ k}}{2 \text{ k}} (1)$ = 1.9 (1) Allow ecf in Q from their values of f_0 and bandwidth	3	2		5	2
		(ii)	Q-factor is a measure of selectivity (1) A high Q factor gives a lower bandwidth (1)	2			2	
	(b)	(i)	$f_0 = \frac{1}{2\pi\sqrt{LC}}$ $f_0 = \frac{1}{2\pi\sqrt{1.5 \times 10^{-3} \times 47 \times 10^{-9}}} = 18955 \text{ Hz}$ Selecting equation and substitution (1) Correct multipliers (1) Answer (accept 19 kHz) (1)	2	1		3	3

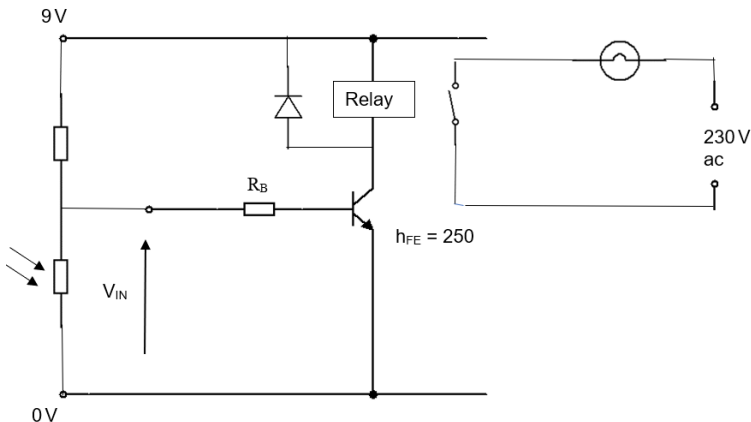
Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	$R_D = \frac{L}{r_L C} = \frac{1.5 \times 10^{-3}}{6 \times 47 \times 10^{-9}} \quad (1)$ $= 5.32 \text{ k}\Omega \quad (1)$ $V_{OUT} = \frac{5.32}{5.32 + 4.7} \times 9 \quad (1)$ $= 4.78 \text{ V} \quad (1) \text{ (accept 4.8 V)}$	1	3		4	3
	(c)	(i)	 Connections: V_{IN} correct (1) Feedback to V^- (1) (-1 if no labels to input and output.)	1	1		2	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(ii)	Indicative content: Issues with linking: • Loading of filter draws current • Changes the resonant frequency / lowers V_{OUT} / properties of the filter Voltage follower • gain = 1 • High input impedance • Low output impedance Solutions: • High input impedance draws no current from filter • Low output impedance allows to match to other sub-systems • Gain of 1 leaves the voltage from the filter unchanged			6	6	

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
			5-6 marks Answer contains a full explanation of the issues of linking the filter, the properties of the voltage follower and the solutions. There is a sustained line of reasoning which is coherent, substantiated and logically structured. The information included in the response is relevant to the argument. 3-4 marks Answer contains an explanation of some of the issues of linking the filter, some of the properties of the voltage follower and some of the solutions. There is a line of reasoning which is partially coherent, supported by some evidence and with some structure. Mainly relevant information is included in the response but there may be some minor errors or the inclusion of some information not relevant to the argument. 1-2 marks Answer contains either an explanation of some of the issues of linking the filter or some of the properties of the voltage follower or some of the solutions. There is a basic line of reasoning which is not coherent, supported by limited evidence and with very little structure. There may be significant errors or the inclusion of information not relevant to the argument. 0 marks No attempt made or no response worthy of credit.					
			Question 7 total	9	7	6	22	8

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
8	(a)	(i)	3.6 k Ω (1)	1			1	
		(ii)	Switch open: $\text{Gain} = - \frac{R_F}{R_{IN}} = - \frac{100}{3.6} = - 27.8 \text{ (2)} \quad (\text{accept; } -28)$ (Only 1 mark if positive. Penalise only once) Switch closed: $R_F = \frac{R_1 \times R_2}{R_1 + R_2} = \frac{100 \times 8.2}{100 + 8.2} \text{ (1)}$ $= 7.6 \text{ k}\Omega \text{ (1)}$ $\text{Gain} = - \frac{7.6}{3.6} = - 2.1 \text{ (1)}$ (Allow ecf from calculation of parallel resistance)	2	3		5	3
		(iii)	$V_{OUT} = \text{Gain} \times V_{IN} = -27.8 \text{ (ecf)} \times 0.1 \text{ (1)}$ $= -2.78\text{V} \text{ (1)}$ (Accept: -2.8 V if a gain of -28 has been used)	1	1		2	2

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
	(b)	(i)	 Same frequency (1) Inverted (1) Peak value 2.8 V (tolerance < ½ small square)	2	1		3	
		(ii)	$T = 80 \times 10^{-6} \text{ s}$ $f = \frac{1}{T} = \frac{1}{80 \times 10^{-6}} \text{ (1)}$ $= 12.5 \text{ kHz (1)}$	1	1		2	2
		(iii)	Slew rate $= 2\pi f V_P = 2\pi \times 12.5 \times 10^3 \text{ (ecf)} \times 2.78 \text{ (ecf)} \text{ (1)}$ $= 218340 \text{ (1) } \text{Vs}^{-1} \text{ (1)}$ or $= 0.21834 \text{ (1) } \text{V}\mu\text{s}^{-1} \text{ (1)}$ (Accept V/s or V/μs) (Accept 219911 Vs⁻¹ or 0.219911 Vμs⁻¹ if 2.8 used)	2	1		3	3
			Question 8 total	9	7		16	10

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
9	(a)		$I_C = \frac{9}{120} = 0.075 \text{ A (1)}$ $I_B = \frac{I_C}{h_{FE}} = \frac{0.075}{250} \text{ (ecf on } I_C) \text{ (1)}$ $= 3 \times 10^{-4} \text{ A or } 0.3 \text{ mA (1)}$ $R_B = \frac{V_B}{I_B} = \frac{3.2 - 0.7}{3 \times 10^{-4}} \text{ (ecf on } I_B) \text{ (1)}$ $= 8.3 \text{ k}\Omega \text{ (1)}$ Preferred value = 8.2 k Ω (ecf) (1)	3	3		6	5
	(b)		 Resistor and LDR in series (1) LDR connected to 0V (1) Diode reverse biased parallel to relay coil (1) Lamp in series with relay switch and AC supply (1) Mains lamp circuit completely correct (1)			5	5	
			Question 9 total	3	3	5	11	5

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
10	(a)	(i)	Number of revolutions = $\frac{80}{10} = 8$ (1) Distance = $1 \times 8 = 8$ m (1)		2		2	2
		(ii)	Smallest distance = $\frac{1}{10} = 0.1$ m or 10 cm (1)		1		1	1
	(b)	(i)	To produce a clean single pulse (wtte) (1)	1			1	
		(ii)	Photodiode (1) Reverse biased (1) Resistor (1)			3	3	
			Question 10 total	1	3	3	7	3

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
11	(a)	(i)	Travel in a straight line / pass through the ionosphere (1)	1			1	
		(ii)	$\lambda = \frac{c}{f} = \frac{3 \times 10^8}{200 \times 10^9} \text{ (1) (no POT penalty in substitution)}$ $= 1.5 \times 10^{-3} \text{ m (1) (must have correct POT)}$	1	1		2	2
	(b)	(i)	$T = 8 \mu\text{s (1)}$ $f = \frac{1}{T} = 125 \text{ kHz (1)}$	1	1		2	2
		(ii)	9 cycles of carrier occur in 1 cycle of signal (1) Carrier frequency = $9 \times 125 \text{ kHz} = 1.125 \text{ MHz (1)}$	1	1		2	
	(c)		$m = \frac{V_{\text{max}} - V_{\text{min}}}{V_{\text{max}} + V_{\text{min}}} \times 100\% \text{ (1)}$ $m = \frac{1.7 - 0.5}{1.7 + 0.5} \times 100\% \text{ (1)}$ $m = 55\% \text{ (Accept 50 – 59%) (1)}$	1	2		3	2
			Question 11 total	5	5		10	6

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
12	(a)		X = Transmitter/encoder (1) Y = Regenerator/repeater (accept: Schmitt trigger) (1) Z = Receiver/decoder (1)	3			3	
	(b)	(i)	Attenuation: A reduction in the amplitude/power of the signal along the communication link. (1) Issue: As the amplitude of the signal reduces the SNR reduces. (1) This can lead to degrading and/or loss of signal. (1)	3			3	
		(ii)	Total loss = $30 + 30 - (20 \times 3.1) = -2 \text{ dB}$ (1) $G_{\text{dB}} = 10 \log_{10} \left(\frac{P_{\text{OUT}}}{P_{\text{IN}}} \right)$ $-2 = 10 \log_{10} \left(\frac{P_{\text{OUT}}}{1} \right) \text{ (1)}$ $10^{-0.2} = \frac{P_{\text{OUT}}}{1} \text{ (1)}$ $P_{\text{OUT}} = 0.63 \text{ W}$ (1) (Do not accept an answer of 0.6 W)	1	3		4	4

Question			Marking details	Marks available				
				AO1	AO2	AO3	Total	Maths
		(iii)	$G_{dB} = 10 \log_{10} \left(\frac{P_{OUT}}{P_{IN}} \right) = 10 \log_{10} \left(\frac{0.8}{0.63} \right) (1)$ $= 1.04 \text{ dB} (1)$ Accept 1.0 dB (Accept answer of 1.25dB if 0.6W used for P_{OUT})	1	1		2	2
			Question 12 total	8	4		12	6

COMPONENT 1

SUMMARY OF MARKS ALLOCATED TO ASSESSMENT OBJECTIVES

QUESTION	AO1	AO2	AO3	TOTAL MARK	MATHS
1	3	3	0	6	0
2	4	15	1	20	6
3	3	9	0	12	5
4	1	5	0	6	6
5	4	3	2	9	2
6	3	6	0	9	6
7	9	7	6	22	8
8	9	7	0	16	10
9	3	3	5	11	5
10	1	3	3	7	3
11	5	5	0	10	6
12	8	4	0	12	6
TOTAL	53	70	17	140	63