Electronics Mark Scheme 2

Level	International A Level				
Subject	Physics				
Exam Board	CIE				
Торіс	Electronics				
Sub Topic					
Paper Type	Theory				
Booklet	Mark Scheme 2				
Time Allowed:	71 minutes				
Score:	/59				
Percentage:	/100				
A* A	B C D E U				
>85% '77.5%	70% 62.5% 57.5% 45% <45%				

1	(a	e.g infi infi infi	e.g. zero output impedance/resistance infinite input impedance/resistance infinite (open loop) gain infinite bandwidth infinite slew rate				
		1 e	each, max. 3	B3	[3]		
	(b)	(i)	graph: square wave correct cross-over points where $V_2 = V_1$ amplitude 5 V correct polarity (<i>positive at t = 0</i>)	M1 A1 A A	[4]		
		(ii)	correct symbol for LED diodes connected correctly between V _{OUT} and earth correct polarity consistent with graph in (i) (<i>R points 'down' if (i) correct</i>)	M1 A1 A1	[3]		
2	(a	light	-emitting diode (<i>allow LED</i>)	В	[1]		
	(b)	give depe	s a high or a low output / +5V or –5V output endent on which of the inputs is at a higher potential	M1 A1	[2]		
	(c)	(provides a reference/constant potential	B1	[1]		
		(ii)	determines temperature of 'switch-over'	B1	[1]		
	(d)	(relay	A1	[1]		
		(ii)	relay connected correctly for op-amp output and high-voltage circuit diode with correct polarity in output from op-amp	B1 B1	[2]		

3 (a) light-dependent resistor (allow LDR)	B1	[1]
(b) (two resistors in series between +5 V line ar midpoint connected to inverting input of op-	nd earth M1 -amp A1	[2]
(ii) relay coil between diode and earth switch between lamp and earth	M1 A1	[2]
(c) switch on/off mains supply using a low volta (allow 'isolates circuit from mains supply')	age/current output B1	[1]
 (ii) relay will switch on for one polarity of output switches on when output (voltage) is negat 	ive C1 A1	[2]
4 (a e.g. infinite input impedance/resistance		
infinite (open loop) gain infinite bandwidth infinite slew rate (any four, one mark each)	B4	[4]
(b) graph: square wave 180° phase change amplitude 5.0 V	M1 A1 A	[3]
 (c) correct symbol for LED diodes connected correctly between V_{OUT} and diodes identified correctly (special case: if diode symbol, not LED symb 	d earth A1 A1 A1 ool, allow 2 nd and 3 rd marks to be scored)	[3]

5	(a) e.ę	i. reduced gain increased stability greater bandwidth or less distortion		
	(al	low any two sensible suggestions, 1 each, max 2)	B2	[2]
	(b) (i)	V^- connected to midpoint between resistors V_{OUT} clear and input to V^+ clear	B1 B1	[2]
	(ii)	gain = $1 + R_F/R$ 15 = 1 + 12000/R $R = 860 \Omega$	C1 A1	[2]
	(c) gra	aph: straight line from (0,0) to (0.6,9.0) straight line from (0.6,9.0) to (1.0,9.0)	B1 B1	[2]
	(d) eit	<i>her</i> relay can be used to switch a large current/voltage output current of op-amp is a few mA/very small relay can be used as a remote switch for inhospitable region/avoids using long heavy cables	M1 A1 (M1) (A1)	[2]
6	(a) to 0	o compare two potentials / voltages utput depends upon which is greater	M1 A1	[2]
	(b) (i) resistance of thermistor = $2.5 k\Omega$ resistance of X = $2.5 k\Omega$	C1 A1	[2]
	(i	 at 5 °C / at < 10 °C, V⁻ > V⁺ so V_{OUT} is −9V at 20 °C / at > 10 °C, V⁻ < V⁺ and V_{OUT} is +9V V_{OUT} switches between negative and positive at 10 °C (allow similar scheme if 20 °C treated first) 	M1 A1 B1 B1	[4]
7	(a) (i)	non-inverting (amplifier)	B1	[1]
	(ii)	$(G =) 1 + R_2 / R_1$	B1	[1]
	(b) (gain = 1 + 100 / 820 output = 17 mV	C1 A1	[2]
	(ii)	9V (R_2 / R_1 scores 0 in (a)(ii) but possible 1 mark in each of (b)(i) and (b)(ii) (1 + R_1 / R_2) scores 0 in (a)(ii), no mark in (b)(i), possible 1 mark in (b)(ii) (1 - R_2 / R_1) or R_1 / R_2 scores 0 in (a)(ii), (b)(i) and (b)(ii))	A1	