



GCE

Electronics

Unit **F611**: Simple Systems

Advanced Subsidiary GCE

Mark Scheme for June 2018

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.










All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

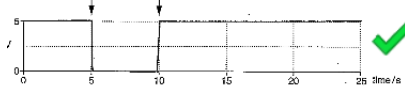
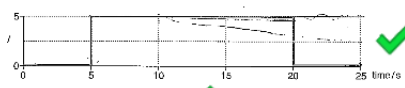
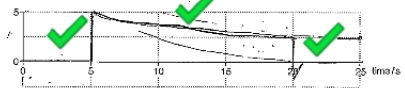
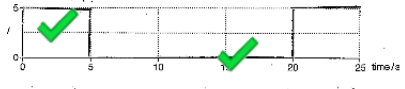
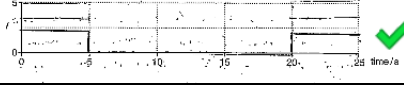
Annotation	Meaning of annotation
	Blank Page – this annotation must be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.

1		31	BOD	Benefit of doubt
2		21	Cross	Cross
3		241	ECF	Error carried forward
4		191	NBOD	Benefit of doubt not given
5		1841	Not Relevant	Expandable vertical wavy line
6		271	REP	Repeat
7		201	TV	Too vague
8		11	Tick	Tick
9		1741	ZERO	Zero (big)
10				

Question	Grade	Expected answer	Mark	Additional guidance															
1a	E	NAND gate	1																
1b		<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>A</th> <th>B</th> <th>C</th> </tr> </thead> <tbody> <tr> <td>0</td> <td>0</td> <td>1</td> </tr> <tr> <td>0</td> <td>1</td> <td>1</td> </tr> <tr> <td>1</td> <td>0</td> <td>1</td> </tr> <tr> <td>1</td> <td>1</td> <td>0</td> </tr> </tbody> </table>	A	B	C	0	0	1	0	1	1	1	0	1	1	1	0		
A	B	C																	
0	0	1																	
0	1	1																	
1	0	1																	
1	1	0																	
	E	all combinations of A and B	1																
	E	C correct	1																
1c	C	$C = \overline{A} \bullet B$	1	$C = \overline{A} \cdot \overline{B} + \overline{A} \cdot B + A \cdot \overline{B}$															
1d	C	Logic gates can only supply a few millamps at output (wtte)	1	Allow Logic gates can only supply a very small/insufficient current at output															
	C	MOSFET can <u>switch</u> large current (with virtually no current at gate) (wtte)	1	Require some notion of MOSFET operation e.g. Allow MOSFETs <u>amplify/boost</u> current for [1]															
1e	E	$W = 0.3 \times 5 = 1.5 \text{ W}$	1																

Question	Grade	Expected answer	Mark	Additional guidance
1f	A	<u>Correct</u> MOSFET symbol	1	No marks for this if first two marks not awarded
	D	MOSFET and lamp in series with power to allow current to flow	1	
	B	Source to 0 V Drain to lamp to provide 5 V to lamp	1	
	D	Gate to output of NAND gate	1	
1g	A	Switch from one input to 0 V	1	
	A	Both inputs correct	1	
	D	Switch and resistor form potential divider across power supply	1	

Question	Grade	Expected answer	Mark	Additional guidance
2a	D	$5 - 2.1 = 2.9$ V (Correct voltage across R)	1	
	E	$2.9 / 330 = 0.0088$ A (voltage divided by 330Ω)	1	
2b	E	R at least $10 \text{ k}\Omega$	1	
	E	Use of $0.7 RC$	1	
	D	$RC = 21.4$ s	1	
2c	B	LED stops glowing	1	No mark if answer indicates slow charging
	E	For 15s	1	
	D	Then turns on again (ecf from first mark)	1	

Question	Grade	Expected answer	Mark	Additional guidance
2d	E	U goes high high at start, goes low between 5 s and 10 s	1	
	C	$W = \overline{U \cdot Y}$	1	
	B	X changes from 0 V to 5 V at 5 s	1	
	B	X decay exponentially	1	
	A	To 2.5 V at 20 s then goes low suddenly	1	
	E	Y starts high	1	
	B	Goes low between 5 s and 20 s then high after 20 s (ecf from X)	1	
	A	Z same shape as Y but only at 0 V and 2.1 V (by eye)	1	

Question	Grade	Expected answer	Mark	Additional guidance
3a	E	$V_{out}=13v$	1	Evidence of correct output voltage used
	E	Voltage across R is $13-3.6=9.4$ V ecf $15-3.6=11.4V$	1	Evidence of subtracting 3.6 v from output
	E	$I=8mA=0.008A$	1	Correct conversion from milli
	E	$R=9.4/0.008$	1	Correct use of Ohm's law
	E	$R=1200\Omega$	1	Correct answer (1) allow ecf at each stage 1200Ω allow more sig figs (1175Ω) [5]
3b	E	Analogue: any value (between minimum and maximum)	1	Ignore comments about A
	E	Digital: one of only two values	1	
	E	Analogue: voltage at B	1	
	E	Digital: Voltage at C or D	1	
3ci	E	Ring around zener	1	
3cii	D	(sharp, $\Delta V < 1$ V) rise from zero current in +ve quadrant (sharp) fall from zero current in –ve quadrant	1	Max 2 if rises not sharp
	C	departs from 0V axis at 0.7V	1	
	B	departs from 0V axis at -5.6V	1	
3ciii	E	5.6V	1	Do not accept -3.6V
3d	E	Resistance falls with increasing light intensity	1	Accept log-log plot
	E	Line curves to be asymptotic to axes	1	
3e	C	Total resistance is $10k + 6.8k = 16.8k$	1	
	C	Current through LDR is $15/16.8k=0.00089A$	1	
	C	Voltage across 6.8k is $0.00089 \times 6.8k=6.1V$	1	

Question	Grade	Expected answer	Mark	Additional guidance
3f	A	LED reverse biased	1	Accept "saturated negative" comparison of voltages at op-amp inputs
	D	Output is -13V	1	
	B	because voltage at inverting input (B) > voltage at non-inverting input (A)	1	
3g	C	Voltage at inverting input (B) = 5.6v	1	Use of potential divider rule with 6.8k Ω Accept 11.4 k Ω for 4 marks
	C	Current through 6.8k is 5.6/6.8k=0.823mA ecf	1	
	B	Voltage across LDR is 15- 5.6=9.4v ecf	1	
	A	Resistance of LDR is 9.4/0.00082=11400 Ω ecf	1	

Question	Grade	Expected answer	Mark	Additional guidance
4a	C	$Q = \overline{\overline{A + B}}$	1	3 rd
4b	A	$P = (\overline{\overline{C \cdot D}}) \cdot \overline{D}$	1	3 rd
4c	A	$R = (\overline{E + F}) \cdot (E + \overline{F})$	1	4 th
4d	A	$S = (\overline{G + H}) \cdot (G + \overline{G})$	1	2 nd

Question	Grade	Expected answer	Mark	Additional guidance
5ai	E	Correct identification of period (6 divisions)	1	400ms worth 1 mark
	E	Correct conversion from divisions to ms (x500ms) 3s	1	
5aai	E	0.33Hz	1	
5aaii	E	5 V	1	
5bi	E	Identifiable oscilloscope symbol connected to 0V	1	
	E	Connection input of OR	1	
5bii	E	0.33 s	1	
5biii	B	+ve spikes – Sharp rise, slow fall	1	Shape
	B	+ve elements go up 2.5 squares	1	Amplitude
	A	+ve elements period 6 squares	1	Period
	A	+ve spikes decay half voltage in ~half a division	1	Decay time
	A	-ve spikes <1 square sharp rise then decay before +ve spikes half way between +ve spikes	1	
5biv	C	Lamp flashes on and off repeatedly	1	No credit for gradual change in LED intensity
	A	with period of 3 s	1	Give mark if on period + off period = 3 s
	A	On for about 0.25 s (0.7RC)	1	Allow 0.2 s – 0.3 s

Question	Grade	Expected answer	Mark	Additional guidance																																				
6a	E D D B	$M = K + L$ $N = \overline{J + K}$ $P = \overline{\overline{J + K}} \quad P = J + K$ $Q = \overline{\overline{(J + K)}} \cdot (K + L) \quad Q = (J + K) \cdot (K + L)$	1 1 1 1	(brackets needed)																																				
6b	E E E E	<table border="1" style="margin-left: auto; margin-right: auto;"> <thead> <tr> <th>M</th> <th>N</th> <th>P</th> <th>Q</th> </tr> </thead> <tbody> <tr><td>0</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>1</td><td>0</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>0</td><td>0</td><td>1</td><td>0</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> <tr><td>1</td><td>0</td><td>1</td><td>1</td></tr> </tbody> </table>	M	N	P	Q	0	1	0	0	1	1	0	0	1	0	1	1	1	0	1	1	0	0	1	0	1	0	1	1	1	0	1	1	1	0	1	1	1 1 1 1	1 mark for each correct column allow ecf from N to P allow ecf from M and P to Q
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Question	Grade	Expected answer	Mark	Additional guidance
6c	E	NOR between J, K and N	1	
	D	OR between L,K and M	1	
	C	NOT between N and P	1	
	A	AND between P, M and Q	1	

Quality of Written Communication

- 3 The candidate expresses complex ideas extremely clearly and fluently. Sentences and paragraphs follow on from one another smoothly and logically. Arguments are consistently relevant and well structured. There will be few, if any, errors of grammar, punctuation and spelling.
- 2 The candidate expresses straightforward ideas clearly, if not always fluently. Sentences and paragraphs may not always be well connected. Arguments may sometimes stray from the point or be weakly presented. There may be some errors of grammar, punctuation and spelling, but not such as to suggest a weakness in these areas.
- 1 The candidate expresses simple ideas clearly, but may be imprecise and awkward in dealing with complex or subtle concepts. Arguments may be of doubtful relevance or obscurely presented. Errors in grammar, punctuation and spelling may be noticeable and intrusive, suggesting weaknesses in these areas.
- 0 The language has no rewardable features.

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