



General Certificate of Education June 2010

ELECTRONICS

ELEC2

Unit 2 Further Electronics

<i>Mark Scheme</i>

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1	(a)		CKs commoned, ✓ Q to D, ✓ data input to first D _A , ✓ Q to respective letter outputs ✓					4	
	(b)		On the rising edge of the CK pulse, ✓ Contents moved one FF to the right ✓					2	
	(c)			clock cycle	A	B	C	D	
				0	0	1	0	1	
1				1	0	1	0		
2				1	1	0	1		
3				1	1	1	0		
4				1	1	1	1		
5				0	1	1	1		
6				0	0	1	1		
one mark for each of last four clock cycles ✓✓✓✓									

Total Mark: 10

2	(a)		correct formula, ✓ substitution, ✓ answer, 714Ω ✓	3
	(b)		correct formula, ✓ substitution, ✓ answer, 771kΩ ✓	3
	(c)		between + and output, ✓ correct way round ✓	2
	(d)		Unchanged for much of the battery useful life ✓ 555 stops working when voltage becomes small (5V) ✓	2

Total Mark: 10

3	(a)	(i)	D to inv. output, ✓ CK to inv. output, ✓ Resets together ✓ label astable input ✓ three labelled outputs ✓	5
	(a)	(ii)	AND gate, ✓ output to Reset, ✓ inputs from Y and Z ✓	3

3	(b)	Binary counter output		Dice output		5
		Denary	Binary Z Y X	Dice number	Lamps on	
		0	0 0 0	1	D	
		1	0 0 1	2	A	
		2	0 1 0	3	D, A	
		3	0 1 1	4	A, C	
		4	1 0 0	5	A, C, D	
		5	1 0 1	6	A, B, C	
		one per correct answer ✓✓✓✓✓				

Total Mark: 13

4	(a)	Formula, ✓ Substitution ✓ $G_v=500$ ✓	3
	(b)	Feedback resistor to output, ✓ Feedback resistor to – input, ✓ Resistor to + input, ✓ Resistor to 0V ✓	4
	(c)	Formula, ✓ substitution, ✓ $1.1\text{M}\Omega$ ✓	3
	(d) (i)	$2.2\text{k}\Omega$ ✓	1
	(d) (ii)	Voltage follower - Input to +, ✓ – to output ✓	2

Total Mark: 13

5	(a) (i)	$5RC$, ✓ $5 \times 100 \times 10^{-7}$, ✓ $= 50\mu\text{s}$ ✓	3
	(a) (ii)	$G_v = 1+2.2 = 3.2$, ✓ $V_{\text{out}} = 3 \times 3.2$, ✓ $= +9.6\text{V}$ ✓	3
	(a) (iii)	$T = RC = 10^{-7} \times 15 \times 10^8$, ✓ $= 150\text{s}$ ✓	2
	(a) (iv)	Output voltage decreases, ✓ exponentially with time ✓	2
	(b)	Input resistance of non-inverting amp very large cf inverting amp, ✓ so output voltage stays at higher level for longer. ✓	2

Total Mark: 12

6	(a)	Formula, ✓ substitution, ✓ only 4.7 ✓	3
	(b)	Gain bandwidth calculation, ✓ BW=640kHz, ✓ Comment on MOSFETs – e.g. MOSFETs have good BW ✓	3
	(c)	Calculation, ✓ 9W in theory, ✓ in practice 5W ✓	3

Total Mark: 9