AQA

General Certificate of Education
June 2010

ELECTRONICS   ELEC2

Unit 2   Further Electronics

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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)		<table><tr><td>clock cycle</td><td>A</td><td>B</td><td>C</td><td>D</td></tr><tr><td>0</td><td>0</td><td>1</td><td>0</td><td>1</td></tr><tr><td>1</td><td>1</td><td>0</td><td>1</td><td>0</td></tr><tr><td>2</td><td>1</td><td>1</td><td>0</td><td>1</td></tr><tr><td>3</td><td>**1**</td><td>**1**</td><td>**1**</td><td>**0**</td></tr><tr><td>4</td><td>**1**</td><td>**1**</td><td>**1**</td><td>**1**</td></tr><tr><td>5</td><td>**0**</td><td>**1**</td><td>**1**</td><td>**1**</td></tr><tr><td>6</td><td>**0**</td><td>**0**</td><td>**1**</td><td>**1**</td></tr></table> one mark for each of last four clock cycles ✓✓✓✓	4

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 ✓ Gv=500 ✓	3
	(b)		Feedback resistor to output, ✓ Feedback resistor to – input, ✓ Resistor to + input, ✓ Resistor to 0V ✓	4
	(c)		Formula, ✓ substitution, ✓ 1.1MΩ ✓	3
	(d)	(i)	2.2kΩ ✓	1
	(d)	(ii)	Voltage follower - Input to +, ✓ – to output ✓	2

Total Mark: 13

5	(a)	(i)	5RC, ✓ $5 \times 100 \times 10^{-7}$, ✓ $= 50\mu s$) ✓	3
	(a)	(ii)	Gv = 1+2.2 = 3.2, ✓ Vout = 3 x 3.2, ✓ = +9.6V ✓	3
	(a)	(iii)	$T = RC = 10^{-7} \times 15 \times 10^{8}$, ✓ = 150s ✓	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