



GCE MARKING SCHEME

SUMMER 2017

**ELECTRONICS - ET5
1145/01**

INTRODUCTION

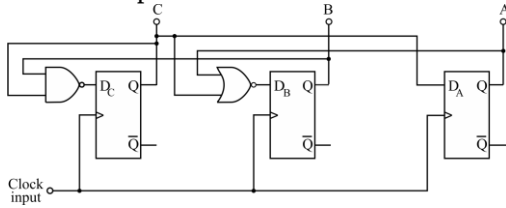
This marking scheme was used by WJEC for the 2017 examination. It was finalised after detailed discussion at examiners' conferences by all the examiners involved in the assessment. The conference was held shortly after the paper was taken so that reference could be made to the full range of candidates' responses, with photocopied scripts forming the basis of discussion. The aim of the conference was to ensure that the marking scheme was interpreted and applied in the same way by all examiners.

It is hoped that this information will be of assistance to centres but it is recognised at the same time that, without the benefit of participation in the examiners' conference, teachers may have different views on certain matters of detail or interpretation.

WJEC regrets that it cannot enter into any discussion or correspondence about this marking scheme.

GCE ELECTRONICS - ET5
SUMMER 2017 MARK SCHEME

1. (a) (i) Stuck state - S_6 (111) 1 mark
(ii) Unused state - S_4 (101) or S_5 (100) or S_7 (010) 1 mark
(iii) Four clock pulses needed 1 mark



- D_A correct 1 mark
 D_B correct 1 mark
 D_C correct 1 mark
Clock connections correct 1 mark

Total for Q1

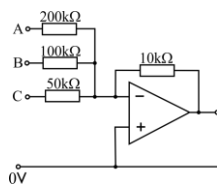
7

2. (a)

State	Current Outputs			Next Outputs		
	C	B	A	D_C	D_B	D_A
0	0	0	0	0	1	0
1	0	1	0	1	0	0
2	1	0	0	1	1	0
3	1	1	0	1	1	1
4	1	1	1	1	0	1
5	1	0	1	0	1	1
6	0	1	1	0	0	1
7	0	0	1	0	0	0

- (i) All correct 1 mark
(ii) $D_A = C.B.\bar{A} + C.B.A + C.\bar{B}.A + \bar{C}.B.A$ 1 mark
Any correct simplification 1 mark
 $D_A = C.(A + B) + A.B$
(Accept: $C.B + A.(C \oplus B)$ or $A.B + A.C + B.C$)

- (b) (i)



Total for Q2

8

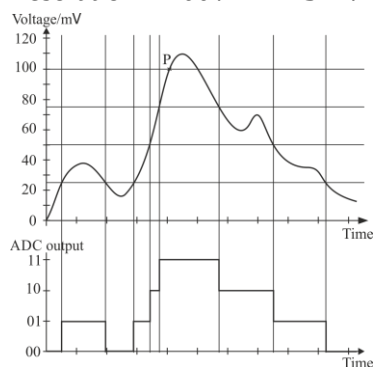
- Three input resistors connected correctly 1 mark
Feedback resistor and non-inverting input connected correctly 1 mark
(ii) Resistor values in correct ratio 1 mark
Lsb input to biggest input resistor 1 mark
(iii) $V_{OUT} = -[(12 \times 10/200) + (0 \times 10/100) + (12 \times 10/50)]$ 1 mark
 $= -3V$ 1 mark
(c) (i) Increase frequency of synchronous counter clock, or equivalent 1 mark
(ii) Increase value of feedback resistor, or equivalent 1 mark
(e.g. increase logic 1 voltage)

Total for Q2

10

3. (a) Resolution = $100 / 2^2 = 25\text{mV}$ 1 mark

(b)



All nine levels correct

Eight levels correct = 2 marks

Seven levels correct = 1 mark

(c) Point 'P' identified correctly

3 marks

1 mark

5

Total for Q3

4. (a) (i) Treble boost = **D** 1 mark

(ii) **Output saturates**, or equivalent

1 mark

(b) (i) At the break frequency, $X_C = R$ or equivalent

(ii) Break frequency = 96.46 Hz (accept any value between 96 and 96.5 Hz)

1 mark

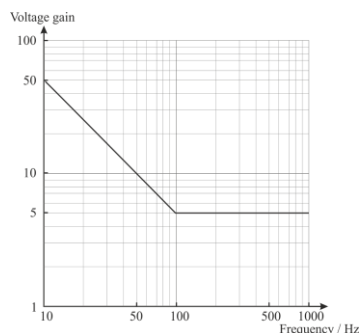
Correct interpretation of multipliers

1 mark

Break frequency = **96 Hz** (accept 96.45 or 96.5)

1 mark

(iii)



Correct shape

1 mark

Correct break frequency and high freq. gain

1 mark

Correct slope for low freq. gain

1 mark

Allow e.c.f. from (b)(ii)

(iv) Frequency = 500 Hz

1 mark

Amplitude = 500 mV (allow ecf from (b)(iii))

1 mark

Total for Q4

10

5. (a) $V_R = 9.0\text{ V}$ (or $V_Z + V_R = 12\text{ V}$)

1 mark

(b)

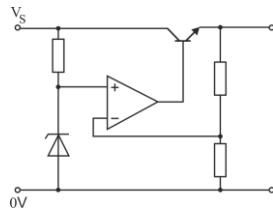
$V_Z = 3.0\text{ V}$

$V_R = 9.5\text{ V}$ (accept 10 V, or $V_Z + V_R = 12.5\text{ V}$)

Both correct

1 mark

(c) (i)



Non-inverting amp

1 mark

Emitter follower

1 mark

Resistor network

1 mark

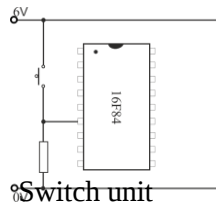
(ii) $R_F:R_1 = 2$ AND both resistors $>1\text{ k}\Omega$

1 mark

Total for Q5

6

6. (a)



Switch unit

Correct orientation

1 mark

1 mark

(b) (i) **Red Yellow Blue** LEDs

1 mark

(ii) Blue lights for **6 s**

1 mark

(iii) Red lights for **12 s**

1 mark

(iv) **209 - checks to see if door is still open**, or equivalent

1 mark

210 - If it is still open, sequence repeats, or equivalent

1 mark

(v) Label added to line **201**

1 mark

(vi) **movf Wstore,0** (or Wstore,W)

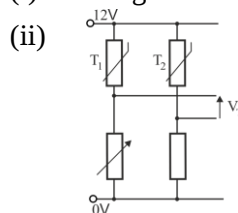
1 mark

Total for Q6

9

7. (a) (i) Voltage at X = **3.75 V** (accept 3.8 V)

1 mark



Second temperature-sensing unit

1 mark

Correct orientation

1 mark

(b) $V_{OUT} = 20 \times +1.5$
 $= -30 \text{ mV}$

Correct voltage gain

1 mark

Correct answer

1 mark

(+30 mV - subtract one mark)

(c) Increase the resistance of variable resistor VR_1
or increase feedback and input resistors

1 mark

Total for Q7

6

8. (a) (i) S_1 **switches on** the heater

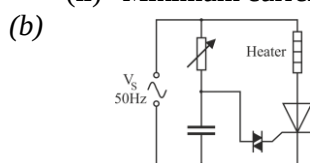
1 mark

S_2 **switches off** the heater

1 mark

(ii) Minimum current = **20 mA**

1 mark

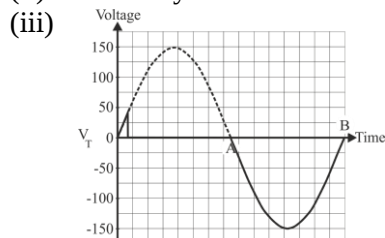


(i) Correct connections for capacitor and variable resistor

1 mark

(ii) Correct symbol AND correct connection for diac

1 mark



Correct shape for positive half-cycle,

1 mark

Switching at 40 V

1 mark

Correct shape for negative half-cycle

1 mark

(iv) Voltage across heater = **0 V**.

1 mark

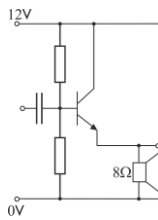
(v) Using $\tan \phi = R / X_C$, setting = **2.97 k Ω** (accept 3 k Ω)

1 mark

Total for Q8

10

9. (a)



Resistor chain connected to base

1 mark

Equal valued resistors AND all $> 1\text{ k}\Omega$

1 mark

Rest of circuit correct

1 mark

(b) (i) Advantage such as low output impedance

1 mark

(ii) Disadvantage such as high quiescent power dissipation in transistor

1 mark

(c) Evidence of correct current – 663 mA

1 mark

Correct answer - 4.4 W

1 mark

Total for Q9

7