



General Certificate of Education

Electronics 1431/2431

ELEC2 Further Electronics

Mark Scheme

2009 examination – June series

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- 1**
- (a) LED in series with resistor ✓
Buzzer from +Vs to output ✓
LED and resistor between output and 0V ✓
 - (b) Correct formula, $(T = 1.1 \times R \times C)$ ✓
Correct substitution, $(T = 1.1 \times (10^6 + 10^5) \times 10^{-3})$ ✓
Correct answer 1210s ✓
 - (c) Output goes high and Discharge switches off ✓
Capacitor charges through resistor(s), ✓
until voltage across capacitor reaches 6V (2/3Vs) ✓
Output goes low, discharge switches on ✓
(max 3)
- (9 marks)
- 2**
- (a) Discharge to junction of $1.2\text{M}\Omega$ and R ✓
Trigger connected to Threshold ✓
Threshold connected to junction of 47nF and R ✓
 - (b) Correct formula, ✓
Correct substitution, ✓
Correct answer $3.0\text{k}\Omega$ ✓
 - (c) Correct formula, ✓
Correct substitution, ✓
(Correct answer 39.6ms)
 - (d) NOT gate, inverting amplifier etc ✓
- (9 marks)
- 3**
- (a) Correct formula, $(T = R \times C)$ ✓
Correct substitution, ✓
Correct answer 3.9ms ✓
 - (b) (i) Correct diagram
input to + input of op-amp, ✓
 R_f to - input, ✓
 R_1 to ground ✓
 - (ii) $1\text{k}\Omega < R_s < 5\text{M}\Omega$ ✓
Ratio of $R_s = 4$ ✓
 - (c) High input resistance ✓
- (9 marks)
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- 4**
- (a) On the rising edge of the clock pulse ✓
Q becomes equal to D, D is sent to Q etc ✓
- (b) D to $\overline{Q}$ ✓
CK to $\overline{Q}$ ✓
Resets to AND output ✓
2nd Q output to AND ✓
4th Q output to AND ✓
- (c) 9 ✓
a, b, c, f, g, (d) ✓ (9 marks)
- 5**
- (a) One resistor to + other to – ✓
-R to output ✓
+R to 0V ✓
- (b) formula ✓
50k Ω ✓
both the same ✓
- (c) left and right hand channels subtracted ✓
the singer is common mode and so is attenuated ✓
the band not common mode so still heard etc ✓ (9 marks)
- 6**
- (a) (i) **P** clearly near op-amp inverting input ✓
(ii) 47k Ω ✓
(iii) formula ✓
- ✓
10 ✓
- (b) additional input resistor ✓
connected to virtual earth point ✓
value 47k Ω ✓
- (c) output = (-)10(mic.1 + mic.2) ✓
or equivalent (9 marks)

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- 7
- (a) gates correct and connected ✓
drains correct and connected ✓
n&p in correct place ✓
 - (b) (i) occurs at low volume ✓
when both MOSFETs are switched off ✓

(ii) MOSFETs biased ✓
included in negative feedback loop ✓
 - (c) formula ✓
 $12^2/(2 \times 4)$ ✓
18W ✓
 - (d) op-amp does not saturate at power supply lines ✓
MOSFETs need V_{gs} to turn on ✓
MOSFETs have r_{ds} ✓
Diode voltage drop ✓
Voltage drop across transistors ✓
(max 3)

(13 marks)