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ASSESSMENT and QUALIFICATIONS ALLIANCE

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 x R x C) ✓
Correct substitution, ($T = 1.1x(10^6+10^5)x10^{-3}$) ✓
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 1.2MΩ and R ✓
Trigger connected to Threshold ✓
Threshold connected to junction of 47nF and R ✓

(b) Correct formula, ✓
Correct substitution, ✓
Correct answer 3.0kΩ ✓

(c) Correct formula, ✓
Correct substitution, ✓
(Correct answer 39.6ms)

(d) NOT gate, inverting amplifier etc ✓ *(9 marks)*

3 (a) Correct formula, (T = RxC) ✓
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) $1k\Omega < R_s < 5M\Omega$ ✓
Ratio of $R_s = 4$ ✓

(c) High input resistance ✓ *(9 marks)*

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 ✓
50kΩ ✓
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) 47kΩ ✓

(iii) formula ✓
- ✓
10 ✓

(b) additional input resistor ✓
connected to virtual earth point ✓
value 47kΩ ✓

(c) output = (-)10(mic.1 + mic.2) ✓
or equivalent *(9 marks)*

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)*