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General Certificate of Education (A-level)
June2013

Electronics ELEC2

(Specification 2430)

Unit 2: Further Electronics

Final

Mark Scheme

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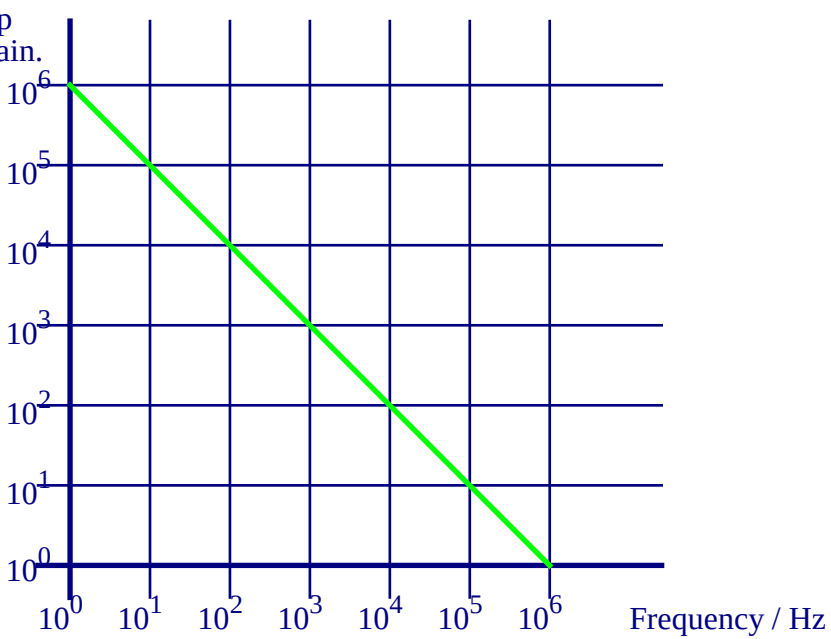
Question	Part	Subpart	Marking guidance		Mark
1	(a)		Feedback resistor from output to –ve input Correct inverting or non-inverting amplifier circuit For inverting, 4.7kΩ and 470kΩ in the correct place For non-inverting, 4.7Ω input resistor AND two resistors in ratio of 99/100		**4**
1	(b)		Formula 120mV 0.12V (No unit error if obvious)		**2**
1	(c)		 Positive gradient = no marks Correct intercept on vertical axis Correct intercept on horizontal axis Straight line joining		**3**

1	(d)		(No possible ecf from (c)) Calculation 10kHz		**2**
2	(a)	(i)	D to $\overline{Q}$ Input to CK Outputs Q or $\overline{Q}$		**3**
2	(a)	(ii)	Output half the frequency of the input Output only changes on rising edge of input		**2**
2	(b)	(i)	Sensible calculation 2.4 (kHz)		**2**
2	(b)	(ii)	$\overline{Q}$ to next clock D to $\overline{Q}$ AND inputs to 1 and 4 AND output to joined Resets		**4**
3	(a)		Resistor between $+V_s$ and discharge Resistor between discharge and trigger Trigger and threshold connected C between threshold and 0V		**4**
3	(b)		Formula Correct substitution 477.6 Hz (Not 480Hz)		**3**
3	(c)		Formula Substitution 108 - 109kΩ (108.591kΩ)		**3**

3	(d)		(Do not accept changes to R_A) Mention of **variable** resistor ✓ Replace R_B with next smallest preferred value and put a small value variable resistor in series. ✓✓ (Sensible answer with **variable** capacitor ✓✓)		**2**
4	(a)		Any mention of RxC ✓ T = RC = 32s ✓ T = 5RC = 160s ✓		**3**
4	(b)		T = RC only T = 5 x 4.7 23.5s		**3**
4	(c)		Formula Substitution 2.35F		**3**
4	(d)		Different leakage currents (or mention of the resistance of the dielectric) Large tolerance so different values.		**2**
5	(a)	(i)	Calculation Answer (400Hz)		**2**
5	(a)	(ii)	Calculation Answer (0.15V) (Accept 0.14V) (P to P = 0.3V, one mark only)		**2**
5	(a)	(iii)	Calculation Answer (3.52W) (7W, one mark only)		**2**
5	(b)		Cross over distortion (Negative) feedback from output (MOSFET sources), (speaker) Bias output transistors into conduction (implication) (Allow mention of diode/LEDs if cross over distortion mentioned)		**3**

5	(c)		50% of maximum power output Giving answer of 20Hz to around 300kHz (If 70% 50Hz – 100kHz then 1 max only)		**2**
6	(a)		Feedback resistor to inverting input Series inverting input resistor Series non-inverting input resistor Resistor from non- inverting input to 0V – same value as R_f All resistors in range 1kΩ to 1MΩ Must have negative feedback then ratio of gain resistors = 100		**6**
6	(b)	(i)	3V		**1**
6	(b)	(ii)	0V No difference The same		**1**
6	(c)		e.g. New resistor values of 198Ω and 202Ω (1% change) Calculation of change in voltage $\frac{6 \times 198}{400} = 3.03V$ so change is 0.03V New output voltage = 0.03 x 100 = 3V		**3**