Prepared by: Dr Jamaludin Bin Omar

EEEB273 - Quiz 4 SEMESTER 2, ACADEMIC YEAR 2013/2014 Date: 15 January 2014 Time: 15 minutes

Question:

Refer to Figure 1.

(a) **Show** that the gain for the circuit is given by:

$$A_{V} = \frac{v_{O}}{v_{I}} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4} / R_{3}}{1 + R_{4} / R_{3}}\right)$$

Show clearly all calculations in order to get full marks.

(b) Calculate A_v when $R_1 = 50 \text{ k}\Omega$, $R_2 = 200 \text{ k}\Omega$, $R_3 = 40 \text{ k}\Omega$, and $R_4 = 20 \text{ k}\Omega$.

(a)

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right)v_{1} [1]$$

$$v_{1} = v_{2} = \frac{R_{4}}{R_{3} + R_{4}}v_{I} = \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right)v_{I} [2]$$

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right)\left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right)v_{I} [2]$$

$$A_{V} = \frac{v_{O}}{v_{I}} = \left(1 + \frac{R_{2}}{R_{1}}\right)\left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) [1]$$
(b)

$$A_{V} = \frac{v_{O}}{v_{I}} = \left(1 + \frac{R_{2}}{R_{1}}\right)\left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) [1]$$

$$A_{V} = \left(1 + \frac{200k}{50k}\right)\left(\frac{20k/40k}{1 + 20k/40k}\right) = 1.67 \text{ V/V} [2, 1]$$

[4 marks]

[6 marks]

1

Refer to Figure 1. (c) **Show** that the output for the circuit is given by:

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4} / R_{3}}{1 + R_{4} / R_{3}}\right) v_{I}$$

(d) Calculate v_0 when $R_1 = 50 \text{ k}\Omega$, $R_2 = 200 \text{ k}\Omega$, $R_3 = 20 \text{ k}\Omega$, $R_4 = 40 \text{ k}\Omega$, and $v_I = 0.01 \text{ V}$. [4 marks] Show clearly all calculations in order to get full marks.

(a)

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) v_{1} [1]$$

$$v_{1} = v_{2} = \frac{R_{4}}{R_{3} + R_{4}} v_{I} = \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) v_{I} [1, 2]$$

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) v_{I} [2]$$
(b)

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) v_{I} [1]$$

$$v_{O} = \left(1 + \frac{200k}{50k}\right) \left(\frac{40k/20k}{1 + 40k/20k}\right) 0.01 = 0.033 \text{ V} [2,1]$$

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[6 marks]

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$$v_{I} \qquad \qquad R_{1} \qquad 1 + R_{4} / I$$
(f) Calculate v_{O} when $R_{1} = 50 \ \text{k}\Omega$, $R_{2} = 200$
Show clearly all calculations in order to get
(a)

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Refer to Figure 1.

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$$A_{V} = \frac{v_{O}}{v_{I}} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4} / R_{3}}{1 + R_{4} / R_{3}}\right)$$

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(e) **Show** that the gain for the circuit is given by:

(f) Calculate
$$v_0$$
 when $R_1 = 50 \text{ k}\Omega$, $R_2 = 200 \text{ k}\Omega$, $R_3 = 40 \text{ k}\Omega$, $R_4 = 20 \text{ k}\Omega$, and $v_I = -0.05 \text{ V}$.
[4 marks]

full marks.



Name: Dr JBO Student ID Number: Model Answer Section: Lecturer: Dr. Jamaludin Bin Omar

[6 marks]

vo

Figure 1

 R_2 ww

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 $v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4} / R_{3}}{1 + R_{4} / R_{3}}\right) v_{I}$

(g) **Show** that the output for the circuit is given by:

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Refer to Figure 1.

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(h) Calculate v_I when $R_1 = 50 \text{ k}\Omega$, $R_2 = 200 \text{ k}\Omega$, $R_3 = 40 \text{ k}\Omega$, $R_4 = 20 \text{ k}\Omega$, and $v_0 = -2.35 \text{ V}$. [4 marks]

Show clearly all calculations in order to get full marks.

(a)

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) v_{1} [1]$$

$$v_{1} = v_{2} = \frac{R_{4}}{R_{3} + R_{4}} v_{I} = \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) v_{I} [1, 2]$$
Figure 1

$$v_{O} = \left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right) v_{I} [2]$$
(b)

$$v_{I} = v_{O} \left(\left(1 + \frac{R_{2}}{R_{1}}\right) \left(\frac{R_{4}/R_{3}}{1 + R_{4}/R_{3}}\right)\right) [1]$$

$$v_{I} = (-2.35) \left(\left(1 + \frac{200k}{50k}\right) \left(\frac{20k/40k}{1 + 20k/40k}\right)\right) = -1.41 \text{ V} [2, 1]$$

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[6 marks]

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