Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 1]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 14 March 2012

Question:

Refer to **Figure 1**. Transistors are matched with K_n = **0.1 mA/V^2**, λ **= 0** and V_{TN} = **1 V.** Given that R_D **= 16 kΩ** and I_Q **= 0.6 mA**. Find the **one-sided output voltage** (V_o) taken at V_{D2} of the differential amplifier when v_1 **= 0.10 V** and v_2 **= 0.15 V**. [10 marks]

Hints: You need to find A_d and v_d first.

Answer:

I_{D2}	$= I_Q/2 = (0.6m)/2 = 0.3$ mA	[1, 1]
g_{m2}	$= 2\,SQRT(K_n\, I_{D2})$	[1]
	$= 2\,SQRT(0.1m \times 0.3m) = 0.3464$ mA/V	[1]
A_d	$= (g_{m2}\, R_D)/2$	[2]
	$= (0.3464m \times 16k)/2 = 2.77$ V/V	[1]
A_d	$= V_o/\, v_d = V_o/(v_1 - v_2)$	[1]
V_o	$= A_d\,(v_1 - v_2)$	[1]
	$= (2.77)(0.10 - 0.15) = -0.1385$ V	[1]

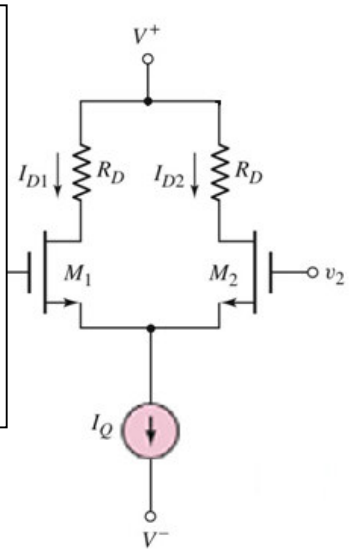

Figure 1

Name:	**Dr JBO**
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Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 2]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 14 March 2012

Question:

Refer to **Figure 1**. Transistors are matched with K_n = **0.1 mA/V^2**, λ = **0** and V_{TN} = **1 V.** Given that R_D = **18 kΩ** and I_Q = **0.62 mA**. Find the **one-sided output voltage** (V_o) taken at V_{D2} of the differential amplifier when v_1 = **0.15 V** and v_2 = **0.10 V**. [10 marks]

Hints: You need to find A_d and v_d first.

Answer:

I_{D2}	= $I_Q/2$ = (0.62m)/2 = 0.31 mA	[1, 1]
g_{m2}	= 2 SQRT(K_n I_{D2})	[1]
	= 2 SQRT(0.1m x 0.31m) = 0.3521 mA/V	[1]
A_d	= (g_{m2} R_D)/2	[2]
	= (0.3521m x 18k)/2 = 3.169 V/V	[1]
A_d	= V_o/ v_d = V_o/(v_1 – v_2)	[1]
V_o	= A_d (v_1 – v_2)	[1]
	= (3.169)(0.15 – 0.10) = 0.1584 V	[1]

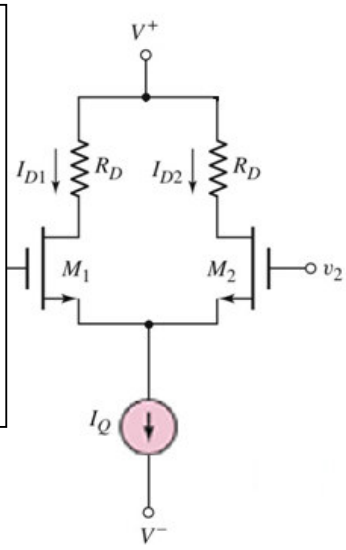

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 3]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 14 March 2012

Question:

Refer to **Figure 1**. Transistors are matched with K_n = **0.1 mA/V^2**, λ = **0** and V_{TN} = **1 V.** Given that R_D = **16 kΩ** and I_Q = **0.62 mA**. Find the **one-sided output voltage** (V_o) taken at V_{D2} of the differential amplifier when v_1 = **0.15 V** and v_2 = **0.10 V**. [10 marks]

Hints: You need to find A_d and v_d first.

Answer:

I_{D2}	= $I_Q/2$ = (0.62m)/2 = 0.31 mA	[1, 1]
g_{m2}	= 2 SQRT(K_n I_{D2})	[1]
	= 2 SQRT(0.1m x 0.31m) = 0.3521 mA/V	[1]
A_d	= (g_{m2} R_D)/2	[2]
	= (0.3521m x 16k)/2 = 2.816 V/V	[1]
A_d	= V_o/ v_d = V_o/(v_1 – v_2)	[1]
V_o	= A_d (v_1 – v_2)	[1]
	= (2.816)(0.15 – 0.10) = 0.1408 V	[1]

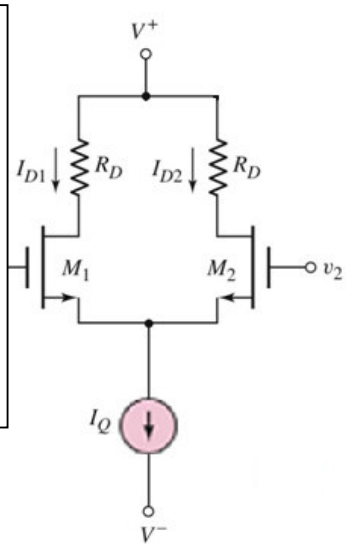

Figure 1

Name:	**Dr JBO**
Student ID Number:	**Model Answer**
Section:	01A / 01B
Lecturer:	Dr. Jamaludin Bin Omar

EEEB273 - Quiz 3 [Question Set 4]
SEMESTER 3, ACADEMIC YEAR 2011/2012
Date: 14 March 2012

Question:

Refer to **Figure 1**. Transistors are matched with K_n = **0.1 mA/V^2**, λ = **0** and V_{TN} = **1 V.** Given that R_D = **18 kΩ** and I_Q = **0.6 mA**. Find the **one-sided output voltage** (V_o) taken at V_{D2} of the differential amplifier when v_1 = **0.10 V** and v_2 = **0.13 V**. [10 marks]

Hints: You need to find A_d and v_d first.

Answer:

I_{D2}	= $I_Q/2$ = (0.6m)/2 = 0.3 mA	[1, 1]
g_{m2}	= 2 SQRT(K_n I_{D2})	[1]
	= 2 SQRT(0.1m x 0.3m) = 0.3464 mA/V	[1]
A_d	= (g_{m2} R_D)/2	[2]
	= (0.3464m x 18k)/2 = 3.117 V/V	[1]
A_d	= V_o/ v_d = V_o/(v_1 – v_2)	[1]
V_o	= A_d (v_1 – v_2)	[1]
	= (3.117)(0.10 – 0.13) = -0.0935 V	[1]

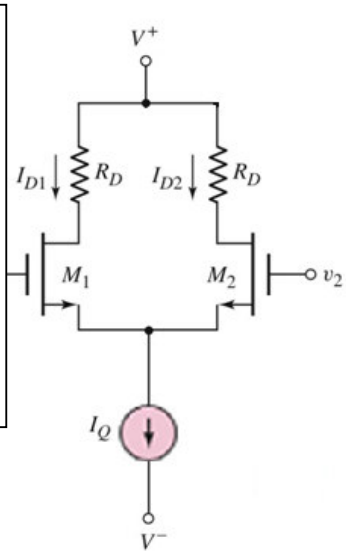

Figure 1