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

EEEB273 - Quiz 5 [Question Set 1]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 22 February 2011

Question:

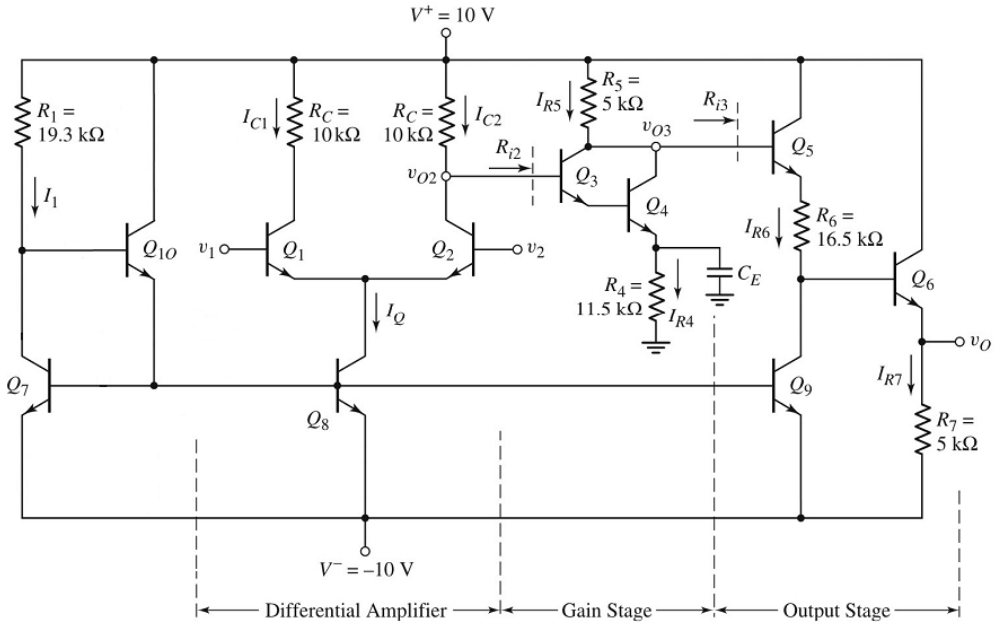

Figure 1

Figure 1 shows a design for a simple bipolar op-amp. *Note that biasing for amplifiers in the circuit is provided by* ***three-transistor current mirrors***. Study the figure carefully. Neglect base currents. Assume parameters for all transistors are: V_{BE}**(on) = 0.7 V**, β **= 100,** and $V_A = \infty$.

Calculate I_1, I_Q, I_{C2}, v_{O2}, and v_{O3}. **Show all your calculation clearly** in order to get full marks.
[10 marks]

Answer: (You may continue your answer in the next page)

I_1	$= (V^+ - V_{BE10} - V_{BE7} - V^-) / (R_1)$		[1]
	$= (10-0.7-0.7-(-10)) / (19.3k)$	$= 0.9637$ mA	[1]
I_Q	$= I_1 / (1 + 2/(\beta(1+\beta))) \approx I_1$	$= 0.9637$ mA	[2]
I_{C2}	$= I_Q / 2$	$= 0.4818$ mA	[2]
v_{O2}	$= V^+ - I_{C2} R_C = 10 - (0.4818m)(10k)$	$= 5.182$ V	[2]
I_{R4}	$= (v_{O2} - 2 V_{BE}(\text{on})) / (R_4)$		
	$= (5.182 - 1.4) / (11.5k)$	$= 0.3288$ mA	[1/2]
I_{R5}	$\approx I_{R4}$ (neglecting base currents)	$= 0.3288$ mA	[1/2]
v_{O3}	$= V^+ - I_{R5} R_5 = 10 - (0.3288m)(5k)$	$= 8.356$ V	[1]

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EEEB273 - Quiz 5 [Question Set 2]
SEMESTER 1, ACADEMIC YEAR 2010/2011
Date: 22 February 2011

Question:

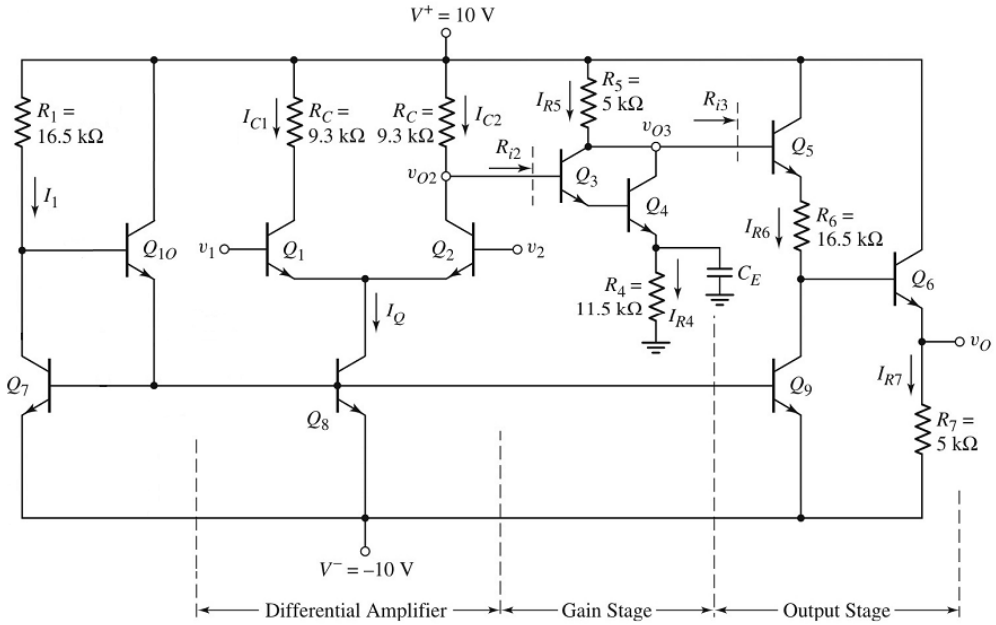

Figure 1

Figure 1 shows a design for a simple bipolar op-amp. *Note that biasing for amplifiers in the circuit is provided by* ***three-transistor current mirrors***. Study the figure carefully. Neglect base currents. Assume parameters for all transistors are: V_{BE}**(on) = 0.7 V**, β **= 100,** and $V_A = \infty$.

Calculate I_1, I_Q, I_{C2}, v_{O2}, and v_{O3}. **Show all your calculation clearly** in order to get full marks.
[10 marks]

Answer: (You may continue your answer in the next page)

I_1	$= (V^+ - V_{BE10} - V_{BE7} - V^-) / (R_1)$		[1]
	$= (10-0.7-0.7-(-10)) / (16.5k)$	$= 1.1272$ mA	[1]
I_Q	$= I_1 / (1 + 2/(\beta(1+\beta))) \approx I_1$	$= 1.1272$ mA	[2]
I_{C2}	$= I_Q / 2$	$= 0.5636$ mA	[2]
v_{O2}	$= V^+ - I_{C2} R_C = 10 - (0.5636m)(9.3k)$	$= 4.758$ V	[2]
I_{R4}	$= (v_{O2} - 2 V_{BE}(\text{on})) / (R_4)$		
	$= (4.758 - 1.4) / (11.5k)$	$= 0.292$ mA	[1/2]
I_{R5}	$\approx I_{R4}$ (neglecting base currents)	$= 0.292$ mA	[1/2]
v_{O3}	$= V^+ - I_{R5} R_5 = 10 - (0.292m)(5k)$	$= 8.54$ V	[1]