EEEB273 - Quiz 4   ☺☺☺
SEMESTER 1, ACADEMIC YEAR 2015/2016
Date: 30 July 2015
Take home quiz. Deadline of submission: 3 August 2015, 5 pm.
You may refer to notes and textbook.

WRITE your answer on clean papers, computer printed answer will not be accepted.

Question:

Consider a simple BJT operational amplifier in **Figure 1**. The circuit parameters are $I_{C7} = I_Q = 0.25$ mA, $I_{C8} = 1$ mA, $R_4 = 10$ kΩ, and $R_3 = 0.2$ kΩ. Assume $\beta = 120$ for all transistors and the **Early voltage** for Q_7 and Q_{11} is **100 V**.

(a) **Find** the values of I_1 and R_1 if $V^+ = 10$ V, $V^- = -10$ V, and $V_{BE} = V_{EB} = 0.7$ V for all transistors **EXCEPT** Q_7 and Q_{11}. [2 marks]

(b) **Determine** the **overall gain (A_v)** of the multistage amplifier in the **Figure 1**. Assume that voltage gain for the input stage (differential amplifier with active load) is A_{v1}, voltage gain for the gain stage (Darlington pair) is A_{v2}, and voltage gain for the output stage (Emitter follower) is $A_{v3} = 1$. [6 marks]

(c) **Calculate** the output resistance (R_o) of the multistage amplifier in the **Figure 1**. [2 marks]
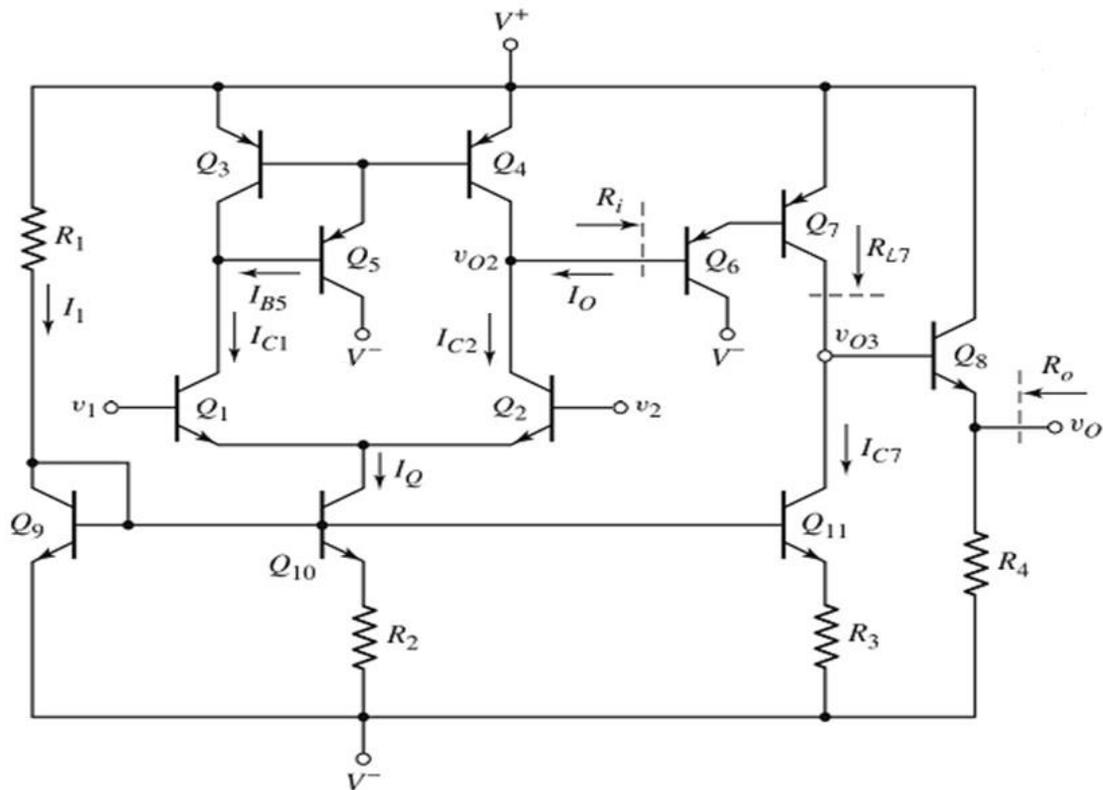

Figure 1

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   (d) **Find** the values of I_1 and R_1 if $V^+ = 12$ V, $V^- = -12$ V, and $V_{BE} = V_{EB} = 0.7$ V for all transistors **EXCEPT** Q_7 and Q_{11}.   [2 marks]

   (e) **Determine** the **overall gain (A_v)** of the multistage amplifier in the **Figure 1**. Assume that voltage gain for the input stage (differential amplifier with active load) is A_{v1}, voltage gain for the gain stage (Darlington pair) is A_{v2}, and voltage gain for the output stage (Emitter follower) is $A_{v3} = 1$.   [6 marks]

   (f) **Calculate** the output resistance (R_o) of the multistage amplifier in the **Figure 1**.   [2 marks]
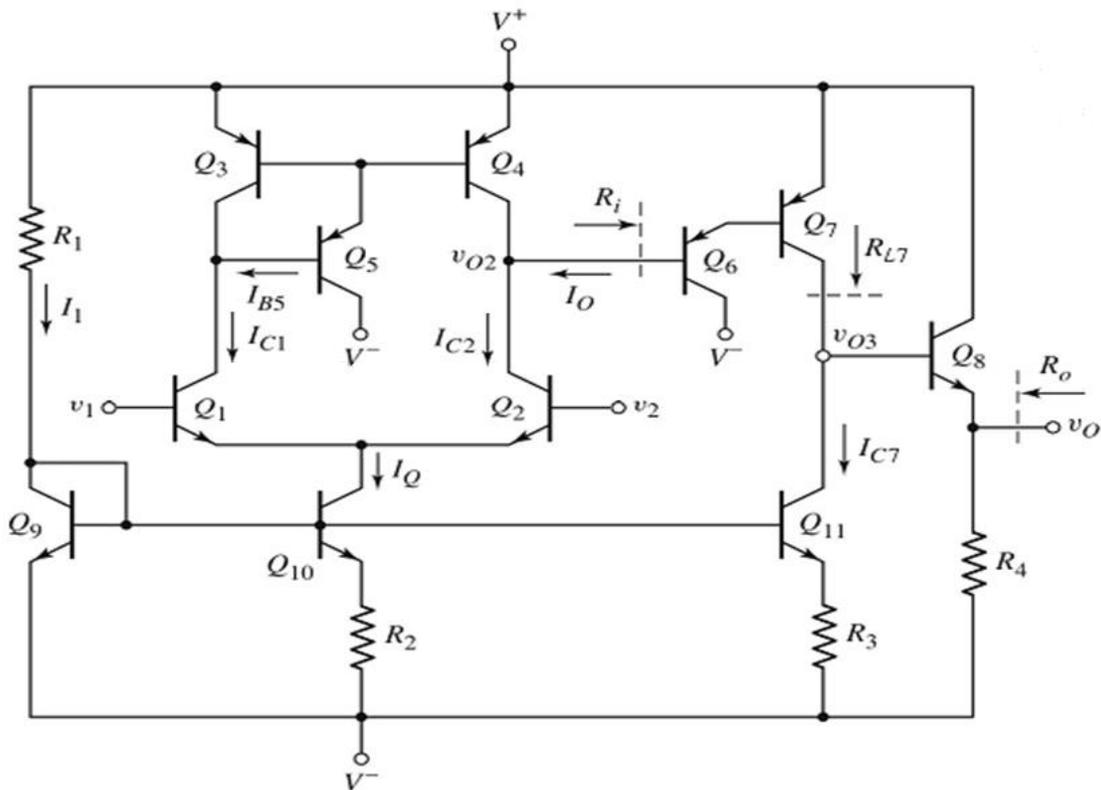

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  (g) **Find** the values of I_1 and R_1 if $V^+ = 12$ V, $V^- = -12$ V, and $V_{BE} = V_{EB} = 0.7$ V for all transistors **EXCEPT** Q_7 and Q_{11}.   [2 marks]

  (h) **Determine** the **overall gain** (A_v) of the multistage amplifier in the **Figure 1**. Assume that voltage gain for the input stage (differential amplifier with active load) is A_{v1}, voltage gain for the gain stage (Darlington pair) is A_{v2}, and voltage gain for the output stage (Emitter follower) is $A_{v3} = 1$.   [6 marks]

  (i) **Calculate** the output resistance (R_o) of the multistage amplifier in the **Figure 1**.   [2 marks]

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Consider a simple BJT operational amplifier in **Figure 1**. The circuit parameters are $I_{C7} = I_Q = 0.2$ mA, $I_{C8} = 1.2$ mA, $R_4 = 10$ kΩ, and $R_3 = 0.2$ kΩ. Assume $\beta = 120$ for all transistors and the **Early voltage** for Q_7 and Q_{11} is **110 V**.

(j) **Find** the values of I_1 and R_1 if $V^+ = 8$ V, $V^- = -8$ V, and $V_{BE} = V_{EB} = 0.7$ V for all transistors **EXCEPT Q_7 and Q_{11}.** [2 marks]

(k) **Determine** the **overall gain (A_v)** of the multistage amplifier in the **Figure 1**. Assume that voltage gain for the input stage (differential amplifier with active load) is A_{v1}, voltage gain for the gain stage (Darlington pair) is A_{v2}, and voltage gain for the output stage (Emitter follower) is $A_{v3} = 1$. [6 marks]

(l) **Calculate** the output resistance (R_o) of the multistage amplifier in the **Figure 1.** [2 marks]
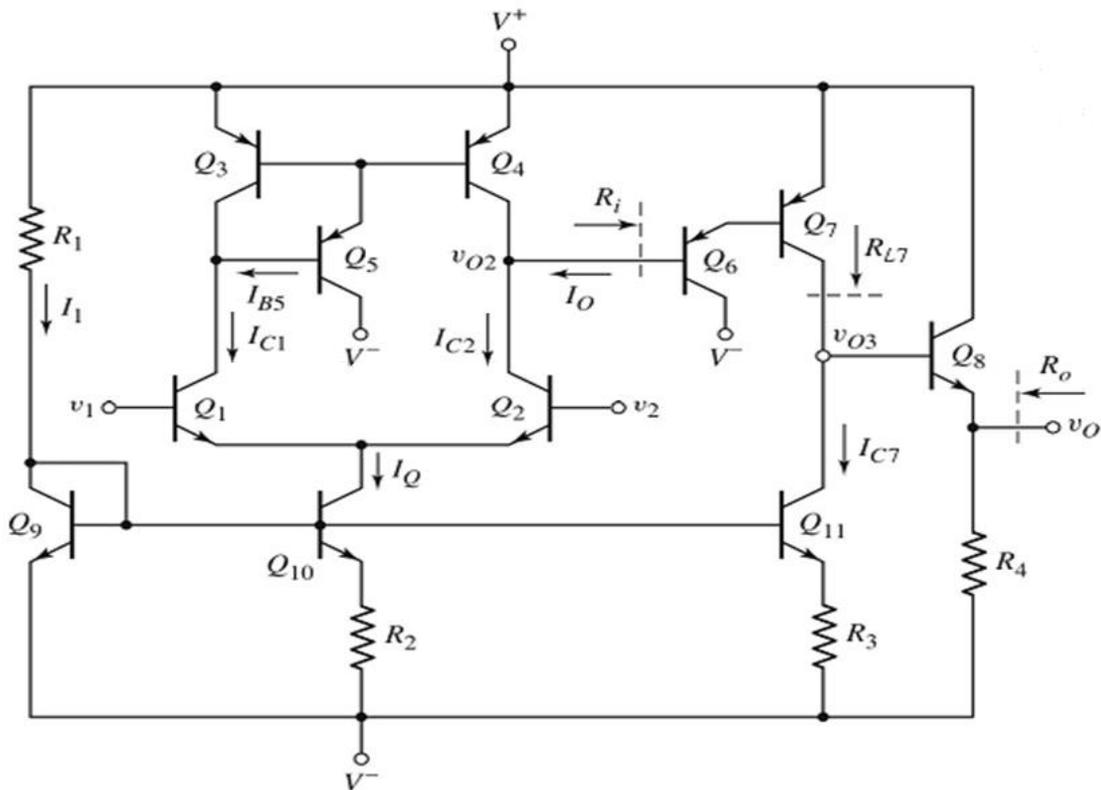

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(m) **Find** the values of I_1 and R_1 if $V^+ = 8$ V, $V^- = -8$ V, and $V_{BE} = V_{EB} = 0.7$ V for all transistors **EXCEPT** Q_7 and Q_{11}. [2 marks]

(n) **Determine** the **overall gain (A_v)** of the multistage amplifier in the **Figure 1**. Assume that voltage gain for the input stage (differential amplifier with active load) is A_{v1}, voltage gain for the gain stage (Darlington pair) is A_{v2}, and voltage gain for the output stage (Emitter follower) is $A_{v3} = 1$. [6 marks]

(o) **Calculate** the output resistance (R_o) of the multistage amplifier in the **Figure 1.** [2 marks]
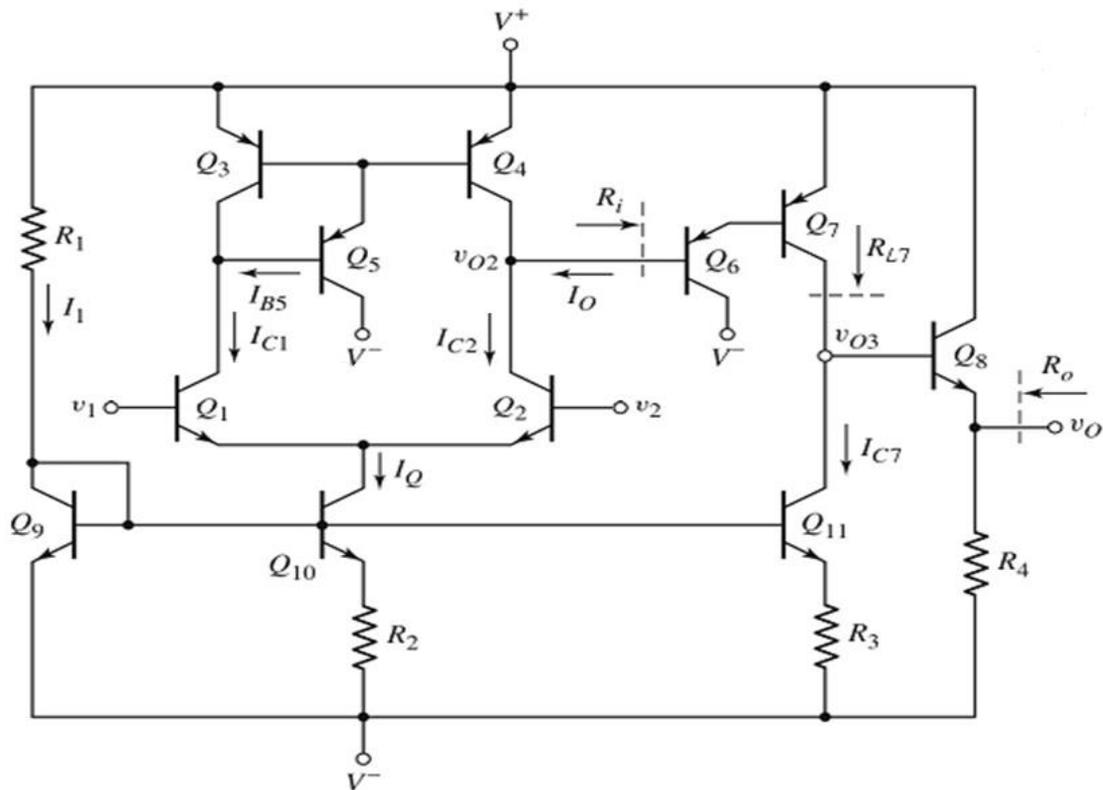

Figure 1