ELG3136A
Fall 2018
Assignment 7

Posting Date: Monday, November 12, 2018

General instructions

1. **Your equations and solutions may be hand-written, scanned into a PDF format.**
2. **A typed solution, with all relevant circuit diagrams drawn with VISIO (or other software), will be given a bonus mark of up to 10% the full mark**
3. **Once you have a PDF file for your entire assignment you can upload it to your account on the Brightspace.**
4. **Only one PDF file will be accepted.**

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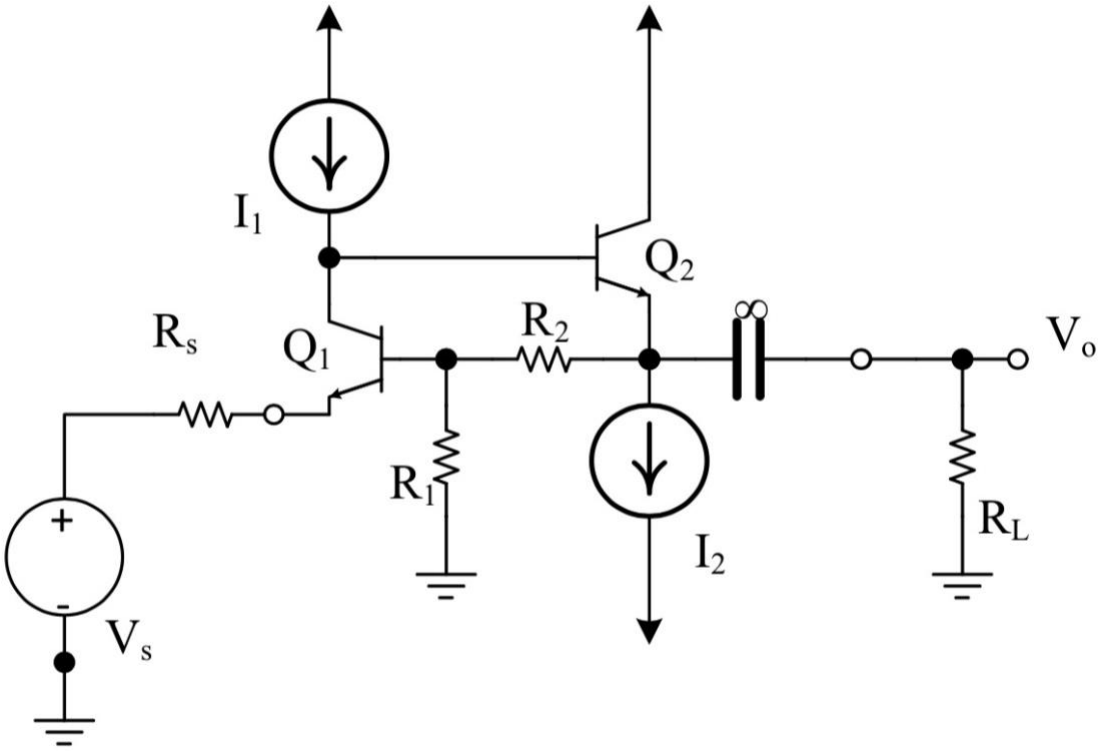

Figure 1

Consider the circuit shown above, where it is given that this circuit is a feedback circuit of Type I, i.e. Voltage-Voltage amplifier.

1. Using DC analysis for the circuit, calculate the DC emitter current for both transistors, and the DC voltage at the emitter of the transistor Q_2.
    - Assume that the transistors are biased in the active mode and that
        - $R_1 = 1k\Omega$
        - $R_2 = 10\ k\Omega$
        - $R_L = 1k\Omega$
        - $R_s = 100\Omega$
        - $\beta_1 = \beta_2 = 100$
        - $I_1 = 0.1$ mA
        - $I_2 = 1$ mA
2. Redraw the circuit in the small-signal domain, while highlighting its feedforward and feedback components.
   As a hint, the circuit must fit in the block diagram shown in Figure 2.

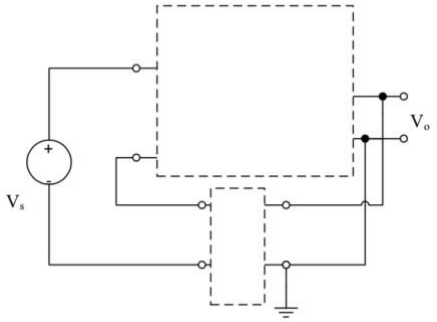

Figure 2

3. Assuming that R_2 is very large, derive an expression for the open-loop voltage gain. You must show clearly how you disconnect the feedback component from the system.
4. Derive an expression for the Feedback gain, *K*.
5. Using the results from the DC analysis above, and using AC small-signal analysis calculate the value of the small-signal open-loop voltage gain.
6. Calculate the overall (closed-loop) voltage gain.