

TOTAL: ____/10

ECE 651: Electronic Design II

Homework #1

Due: Friday, September 8th, 2023

Student Name: _____

Note: Please use this as a cover page for your paper submission.

1. Simulate the following circuits on Multisim and obtain the transfer characteristics (V_{out} vs. V_{in}) for each amplifier circuit. For BJT, use the NPN silicon transistor (model: 2N2222A). For FET, use the n-channel MOSFET (model: 2N7000).

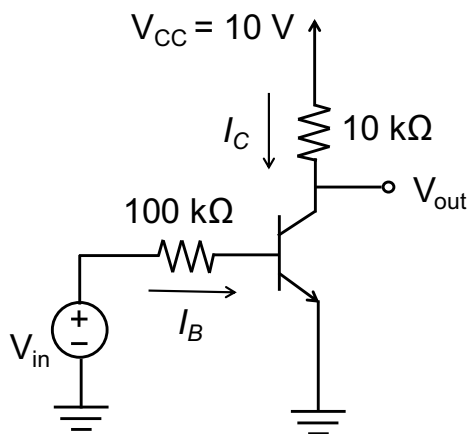


Figure 1. A BJT amplifier.

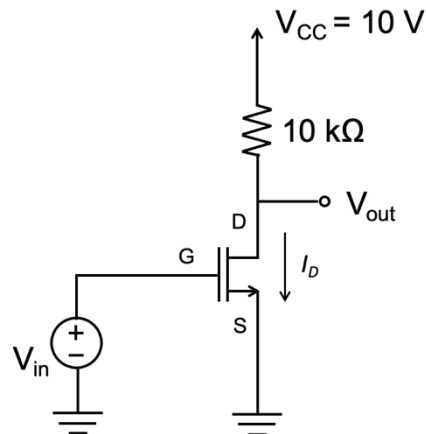
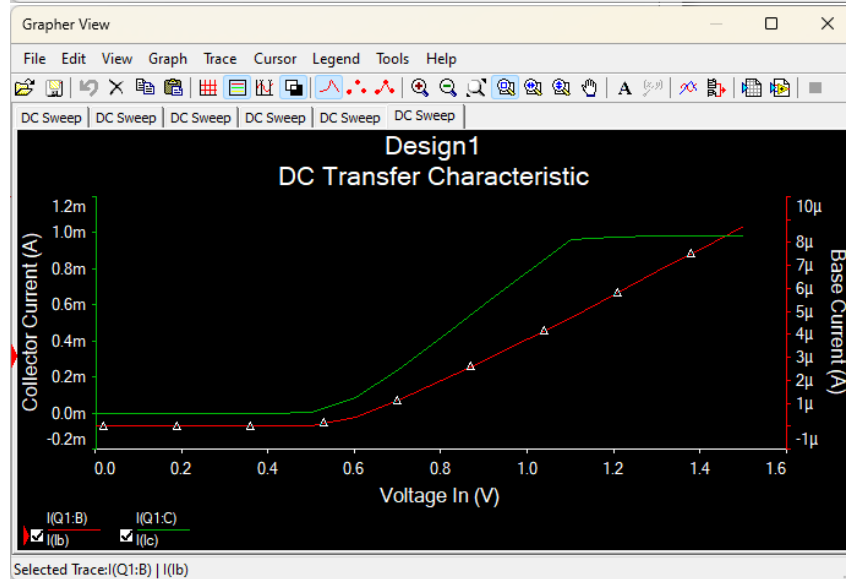
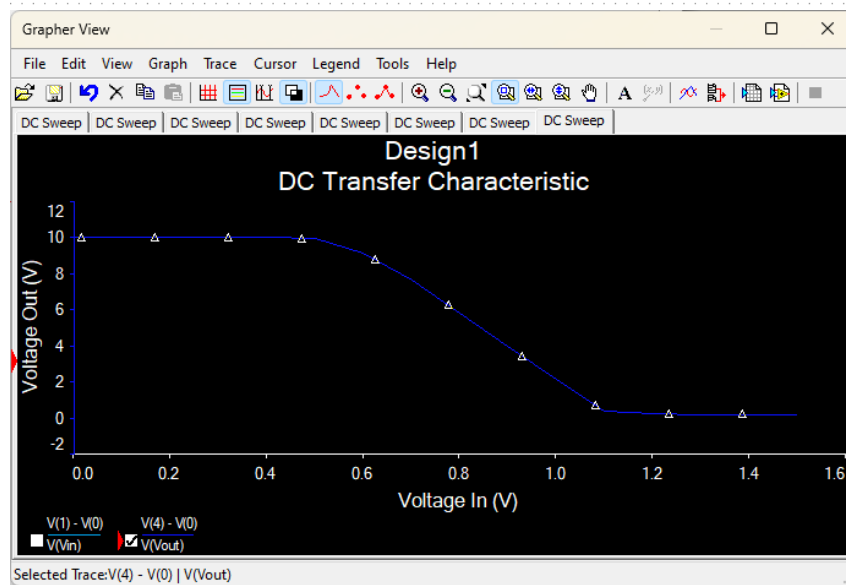
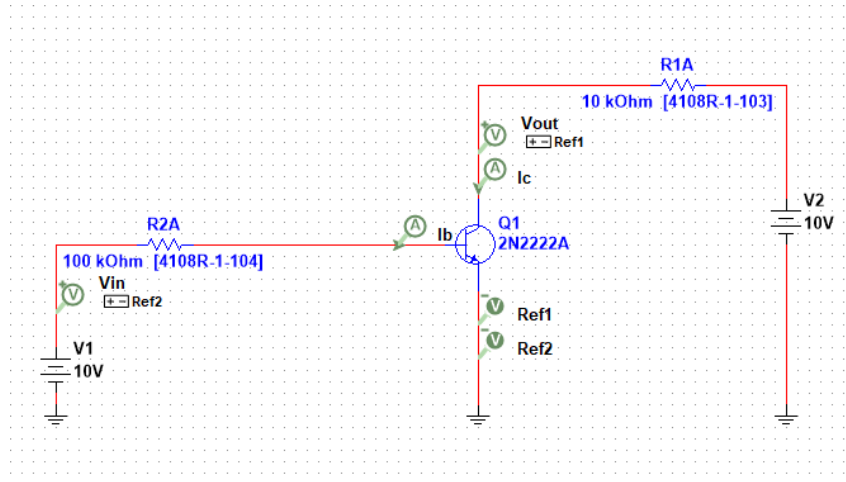


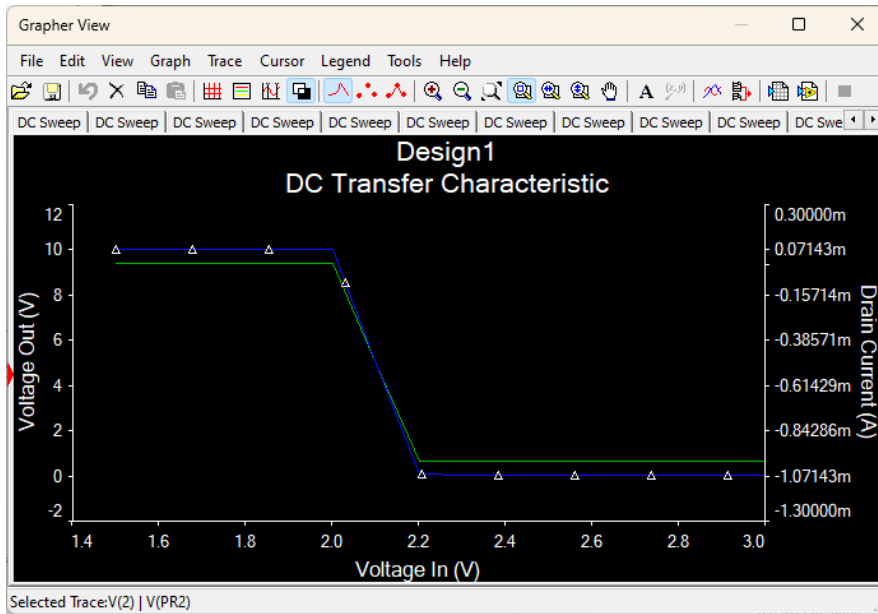
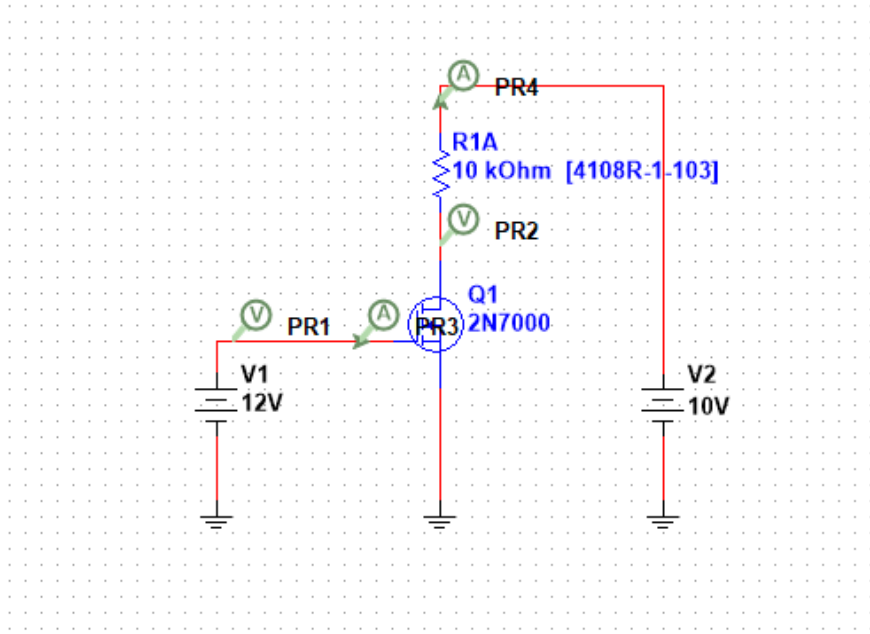
Figure 2. A MOSFET amplifier.

- (a) For the BJT amplifier, generate the following plots:
 - V_{out} vs. V_{in} .
 - I_C vs. V_{in} and I_B vs. V_{in} on the same graph. Plot I_C on the left vertical axis and I_B on the right vertical axis (V_{in} on horizontal axis).
- (b) For the FET amplifier, generate the following plot:
 - V_{out} vs. V_{in} and I_D vs. V_{in} on the same graph. Plot V_{out} on the left vertical axis and I_D on the right vertical axis
- (c) For the FET amplifier, choose the transistor parameters V_{TN} and k_N that closely match your simulated Voltage Transfer Characteristic (VTC) curve. Draw your approximated (linear) VTC based on your calculations on the graph obtained in part (b).

Note:

- Make sure that each axis is properly labeled (e.g., V_{out} , I_C , etc.) and units (e.g., mA, V, etc.) must be provided.
- For submission, convert your worksheets (including this cover page with your name) into a PDF format and submit electronically on Canvas.
- Also, submit your Multisim files (file extension: .ms14) along with your PDF worksheets.





Handwritten calculations on graph paper:

$$V_t = 2V$$

$$I_0 = \frac{K_n}{2} (V_{gs} - V_t)^2 \rightarrow \frac{2I_0}{(V_{gs} - V_t)^2} = \frac{2m}{(2.2 - 2)^2} = \frac{0.002}{0.04}$$

$$I_0 = 1mA$$

$$= 0.05 mA/V^2$$