EE230 - Analog Lab Midsem
Spring Semester: Year 2021-22

February 17, 2022

Timing: 3:00 PM to 4:05 PM **Part-B** Max marks: 10

Instructions:

- **Read each question carefully. Also, strictly follow the upload instructions and timelines given in the questions.**
- **No additional time will be given.**
- **You can refer:** NGSPICE tutorial, model files uploaded on the course moodle / MS Teams channel and your written netlists of previous experiments / homeworks.

---

1. **Question 2**

   (a) From the given set of data-points in table [1c], sketch and annotate the transfer characteristics for the circuit shown in figure [1] and write the expression for V_{OUT} in terms of V_{IN} and V_{REF}. **[3 marks]**

   (b) Design the circuit shown in figure [1] to obtain the transfer characteristics in part-a. Tabulate the calculated values of resistors R_F, R_G, R_1, R_2 and V_{REF}. **Choose the closest value from the standard set of values of the resistors given in figure [3]** **[2 marks]**

   [Upload the hand-drawn sketch, derivations and design values for Q.2 (a) and (b) in a single pdf file with the file name "Q2_a_b_roll_no.pdf" on moodle in 15 min, i.e., from 3 PM to 3:15 PM].

   (c) Write an NGSPICE netlist to simulate the circuit designed in part-b. Plot the V_{OUT} vs V_{IN}. Compare the obtained plot with your hand-drawn sketch in part-a. Write your comments. **[3 marks]**

V_{IN} = 650 mV	V_{OUT} = 0V	1^{st} pair of data points
V_{IN} = 400 mV	V_{OUT} = 4V	2^{nd} pair of data points

(d) Repeat part-c for the given offset values of the resistors R_F, R_G, R_1, R_2 and input offset voltage, V_{OS} equal to $2mV$ as given in figure [2]. **[2 marks]**

[Upload the netlists, plots and observations (hand-written on a paper or typed in a document file) for Q.2 (c) and (d) in a single zip file with the file name "Q2_c_d_roll_no.zip" on moodle in 50 min, i.e., from 3:15 PM to 4:05 PM]

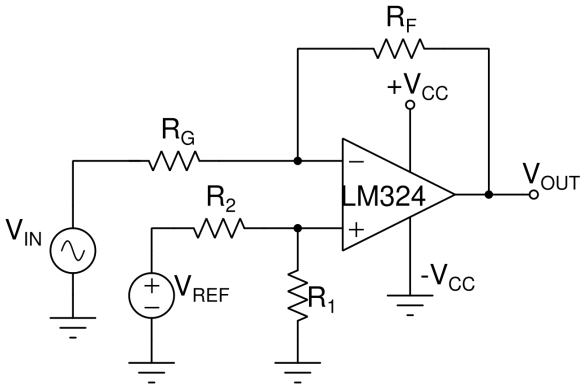

Figure 1: Circuit schematic for Q2-c

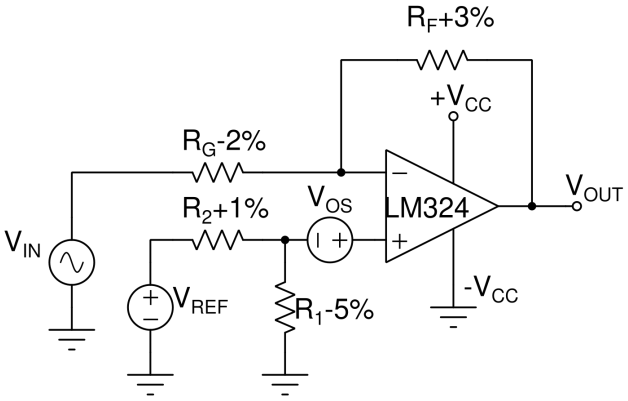

Figure 2: Circuit schematic with the resistor offset values and offset voltage (V_{OS})

Value	Value	Value	Value	Value	Value	Value
1 Ω	10 Ω	100 Ω	1 kΩ	10 kΩ	100 kΩ	1 MΩ
1.2 Ω	12 Ω	120 Ω	1.2 kΩ	12 kΩ	120 kΩ	1.2 MΩ
1.5 Ω	15 Ω	150 Ω	1.5 kΩ	15 kΩ	150 kΩ	1.5 MΩ
1.8 Ω	18 Ω	180 Ω	1.8 kΩ	18 kΩ	180 kΩ	1.8 MΩ
2.2 Ω	22 Ω	220 Ω	2.2 kΩ	22 kΩ	220 kΩ	2.2 MΩ
2.7 Ω	27 Ω	270 Ω	2.7 kΩ	27 kΩ	270 kΩ	2.7 MΩ
3.3 Ω	33 Ω	330 Ω	3.3 kΩ	33 kΩ	330 kΩ	3.3 MΩ
3.9 Ω	39 Ω	390 Ω	3.9 kΩ	39 kΩ	390 kΩ	3.9 MΩ
4.7 Ω	47 Ω	470 Ω	4.7 kΩ	47 kΩ	470 kΩ	4.7 MΩ
5.6 Ω	56 Ω	560 Ω	5.6 kΩ	56 kΩ	560 kΩ	5.6 MΩ
6.8 Ω	68 Ω	680 Ω	6.8 kΩ	68 kΩ	680 kΩ	6.8 MΩ
8.2 Ω	82 Ω	820 Ω	8.2 kΩ	82 kΩ	820 kΩ	8.2 MΩ

Figure 3: Standard Resistors values with a tolerance of $\pm 10\%$