American University of Beirut
Faculty of Engineering and Architecture
Department of Electrical and Computer Engineering
ELEG 042 - Analog Electronics
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Quiz 1
Thursday November 23, 2000

Closed Book
Programmable Calculators Are Not Allowed.

Time: 1.5 hours

VERSION **A**

Name:_____ ID#:_____

► Provide your answer on the *computer card only*.
► Return the computer card attached to the question sheet.
► Use a pencil for marking your answers and ID number on the computer card.
► When using an eraser, make sure you erased well.
► On this sheet, write with a pen your name followed by your ID number.
► All questions are equally graded.
► *Only the computer card will be considered in grading.*

PENALTY is FOUR to ONE

1. What is the version of your question sheet? (This question is not graded.)

   a) Version A
   b) Version B
   c) Version C
   d) Version D
   e) Version E

Assume in all problems that:
$|V_{BE}| = 0.7$ V
$V_T = 25$ mV
$\beta = 100$ unless otherwise specified
Capacitors are very large
Early effect is negligible unless otherwise specified

In the circuit of Figure 1, $R_B = 300K$.

2. Find the voltage gain v_o/v_i.

a) –0.81 b) –0.97 c) –1.59 d) –2.34 e) –1.21

3. Find the input resistance R_i in KΩ.

a) 380.5 b) 175.8 c) 292.7 d) 339.6 e) 238.7

4. Find the current gain i_o/i_i.

a) –41.2 b) –31.0 c) –35.4 d) –38.1 e) –33.0

In the circuit of Figure 2, assume $R_E = 0.5K$.

5. Find the voltage gain v_o/v_i.

a) 0.900 b) 0.928 c) 0.952 d) 0.825 e) 0.943

6. Find R_{ib2} at the base of Q_2 (in KΩ.)

a) 203.2 b) 253.9 c) 152.4 d) 101.6 e) 50.8

7. Find R_{ib1} at the base of Q_1 (in MΩ.)

a) 16.39 b) 11.36 c) 21.74 d) 27.03 e) 6.17

8. Find the current gain i_o/i_i.

a) 396.6 b) 220.1 c) 152.3 d) 94.3 e) 116.5

In the circuit of Figure 3, assume $V_{CC} = 12V$.

9. Find the voltage gain v_o/v_i.

a) 95.2 b) 75.2 c) 35.3 d) 55.2 e) 115.2

10. Find the input resistance v_i/i_i in Ohms.

a) 8.5 b) 27.3 c) 13.0 d) 17.6 e) 10.3

In the circuit of Figure 4, assume I = 2.5mA.

11. Find the differential voltage gain $(v_{c1} – v_{c2})/v_d$, when $v_{B1} = +v_d/2$ and $v_{B2} = -v_d/2$.

a) –9.9 b) –11.3 c) –12.4 d) –13.2 e) –11.9

12. Find the differential input resistance R_{id} in KΩ.

a) 26.5 b) 30.3 c) 22.7 d) 25.3 e) 24.2

13. Find the input bias current in microAmps when **β_1=80** and **β_2=120**.

a) 12.88 b) 5.15 c) 10.31 d) 20.61 e) 8.24

14. Find the input offset current in microAmps when **β_1=80** and **β_2=120**.

a) 4.08 b) 8.16 c) 5.10 d) 2.04 e) 3.26

15. A differential amplifier has a CMRR of 70 dB. The output voltage is 100 mV when the inputs are v_1 = 21.5 mV and v_2 = 20 mV. Find the differential gain of this amplifier.

a) 66.4 b) 53.5 c) 58.6 d) 46.4 e) 63.9

In the circuit of Figure 5, the MOSFETs have V_t = 2.2V and ½ $k'_n(W/L)$ = 1 mA/V^2. Neglect body effect and channel length modulation.

16. Find I_D in mA.

a) 0.090 b) 0.0563 c) 0.116 d) 0.0730 e) 0.160

17. Find g_m for the MOSFETs in mA/V.

a) 0.600 b) 0.540 c) 0.474 d) 0.800 e) 0.681

18. Find v_{o1}/v_s.

a) –5.12 b) –5.68 c) –7.58 d) –4.49 e) –6.45

19. Find v_{o2}/v_s.

a) 18.4 b) 29.3 c) 22.7 d) 40.4 e) 14.2

20. Find r_o in KΩ for the MOSFETs given that channel length modulation for AC signals is not negligible and is modeled by $\lambda = 0.1\ V^{-1}$.

a) 62.5 b) 177.7 c) 137.0 d) 111.1 e) 86.2

21. Find R_o in KΩ, given that channel length modulation for AC signals is not negligible and is modeled by $\lambda = 0.1\ V^{-1}$.

a) 16.9 b) 17.5 c) 16.2 d) 15.2 e) 18.0

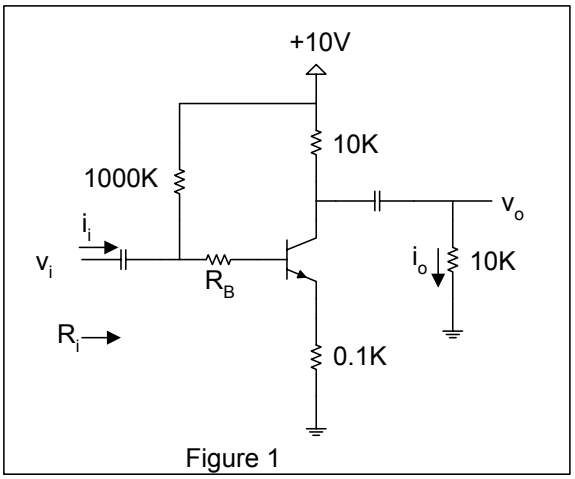

Figure 1

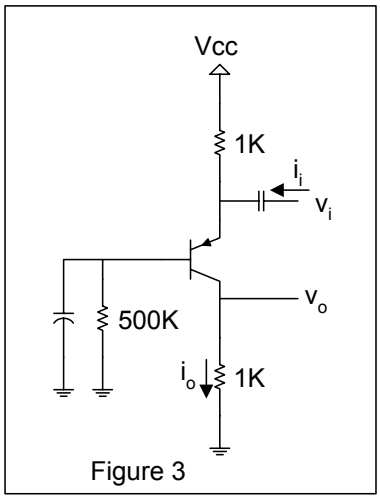

Figure 3

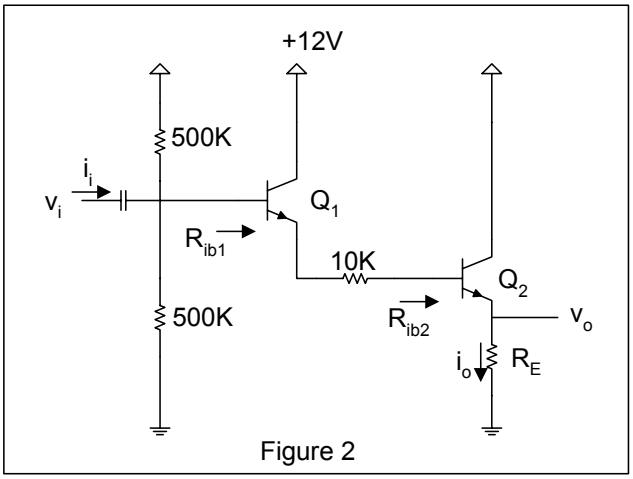

Figure 2

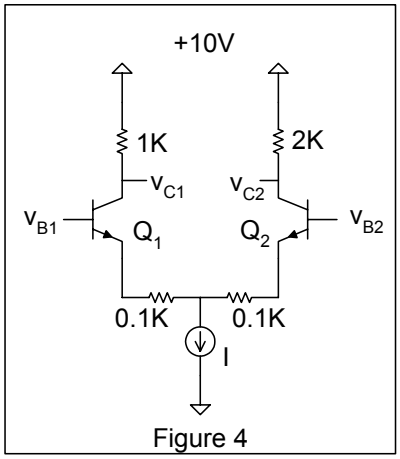

Figure 4

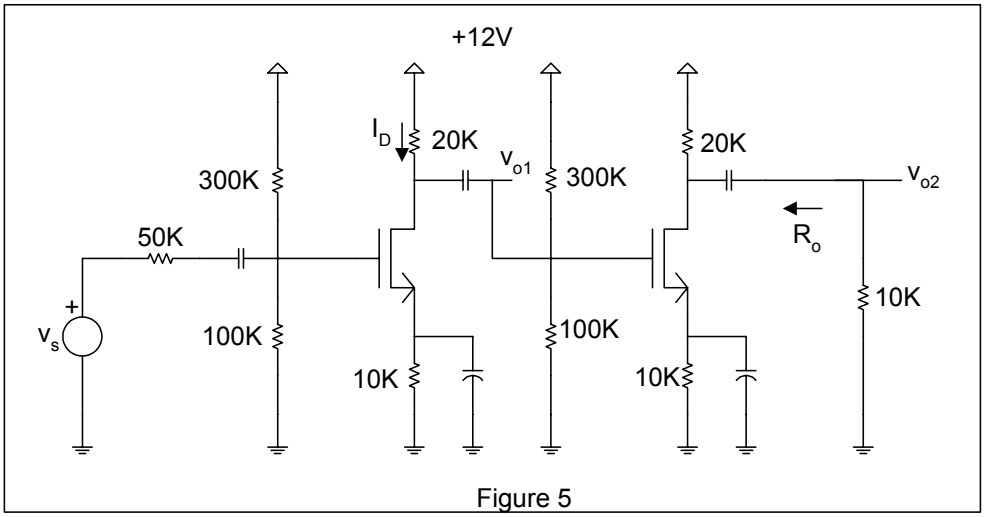

Figure 5