American University of Beirut
Faculty of Engineering and Architecture
Department of Electrical and Computer Engineering
EE 042 - Analog Electronics
Instructor: A. Kayssi
Quiz 1
Saturday November 29, 1997

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 graded equally.

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

2. Find the resistance r_o for the MOSFET shown in Figure 1. The MOSFET parameters are K = 0.25 mA/V^2, V_t = 1.1V, and $V_A = 1/\lambda$ = 60 V. Neglect λ in the DC analysis.
a. 261.7 KΩ
b. 250.8 KΩ
c. 273.6 KΩ
d. 286.5 KΩ
e. none of the above

3. Calculate the voltage gain, v_o/v_s in the circuit of Figure 1. The MOSFET parameters are K = 0.25 mA/V^2, V_t = 1.1V, and $V_A = 1/\lambda$ = 60 V. Neglect λ in the DC analysis.
a. -6.45
b. -6.71
c. -6.84
d. -6.58
e. none of the above

4. For the differential amplifier shown in Figure 2, calculate the output voltage v_o when $v_1 = 26 \sin(\omega t)$ mV and $v_2 = 24 \sin(\omega t)$ mV. The differential gain is 100 and the CMRR is 60 dB.
a. 202.5 sin(ωt) mV
b. 207.9 sin(ωt) mV
c. 225 sin(ωt) mV
d. 279.1 sin(ωt) mV
e. none of the above

5. For the differential amplifier shown in Figure 3, calculate the collector current of transistor Q_1. Assume V_{BE} = 0.7 V, V_T = 25 mV and R_E = 10 KΩ. Neglect the DC base current in your calculations.
a. 75.8 μA
b. 37.9 μA
c. 22.8 μA
d. 113.8 μA
e. none of the above

6. In the circuit of Figure 3, calculate the CMRR. Assume V_{BE} = 0.7 V, V_T = 25 mV, and R_E = 10 KΩ. Neglect the DC base current in your calculations. The BJTs have β = 85 and V_A = 70V.
a. 93.3 dB
b. 89.6 dB
c. 94.3 dB
d. 91.2 dB
e. none of the above

7. For the circuit shown in Figure 4, find the voltage gain v_o/v_s. Assume V_{BE} = 0.7V , V_T = 25 mV, β = 100, V_A = 100 V, and R_S = 1 KΩ. Negelct the DC base current in your calculations.
a. 0.922
b. 0.826
c. 0.963
d. 0.876
e. none of the above

8. Find r_o for the three transistors shown in Figure 5. Transistor Q_1 parameters are: K = 5 mA/V^2, V_t = -2 V, $V_A = 1/\lambda$ = 50 V. Transistor Q_2 parameters are β = 150 and V_A = 80 V. Transistor Q_3 parameters are β = 80 and V_A = 60 V. Assume V_{BE} = 0.7 V and V_T = 25 mV. Neglect λ in the DC analysis of the MOSFET. Also, neglect the DC base currents of the BJTs. Assume V_{CC} = 9 V.
a. r_{o1} = 10 KΩ; r_{o2} = 100 KΩ; r_{o3} = 44.81 KΩ
b. r_{o1} = 10 KΩ; r_{o2} = 49.23 KΩ; r_{o3} = 25.28 KΩ
c. r_{o1} = 10 KΩ; r_{o2} = 65.98 KΩ; r_{o3} = 32.33 KΩ
d. r_{o1} = 10 KΩ; r_{o2} = 39.26 KΩ; r_{o3} = 20.76 KΩ
e. none of the above

9. Refer to the given of Problem 8. Find the gain of the last stage (v_o/v_3).
a. 0.926
b. 0.945
c. 0.964
d. 0.957
e. none of the above

10. Refer to the given of Problem 8. Find the gain of the middle stage (v_3/v_2) taking into consideration the loading effect of stage 3 on stage 2.
a. -214
b. -263.5
c. -109.8
d. -162.8
e. none of the above

11. Refer to the given of Problem 8. Find the overall gain v_o/v_s.
a. 919.7
b. 1086.6
c. 727.8
d. 507.2
e. none of the above

12. What is the input resistance of the circuit in Figure 5?
a. 200 Ω
b. 9.9 KΩ
c. 10 KΩ
d. 1010 KΩ
e. none of the above

13. Find the range of values of I_o in the circuit of Figure 6 when β varies between 30 and 300. Assume that V_{BE} = 0.7 V and R = 100 KΩ.
a. 25 to 25.7 μA
b. 30 to 30.9 μA
c. 37.5 to 38.6 μA
d. 45 to 46.3 μA
e. none of the above

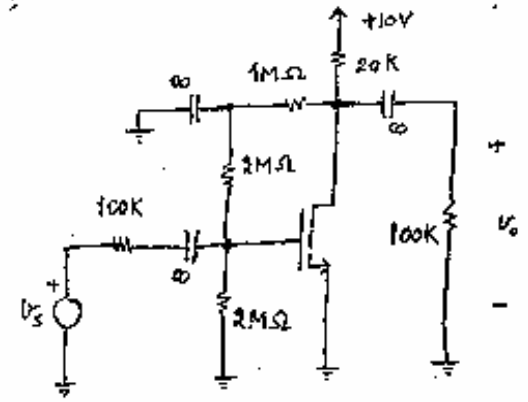

Figure 1

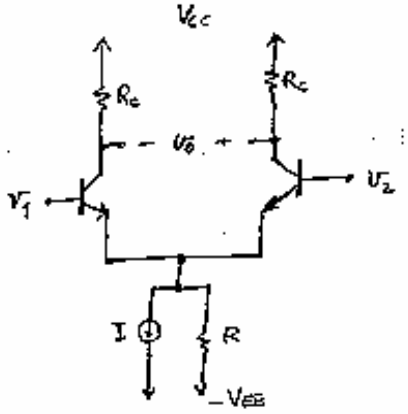

Figure 2

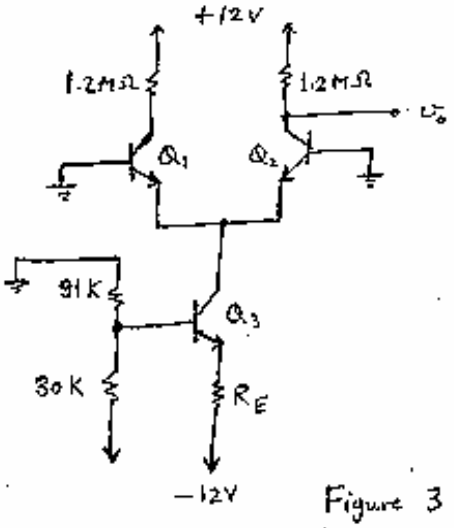

Figure 3

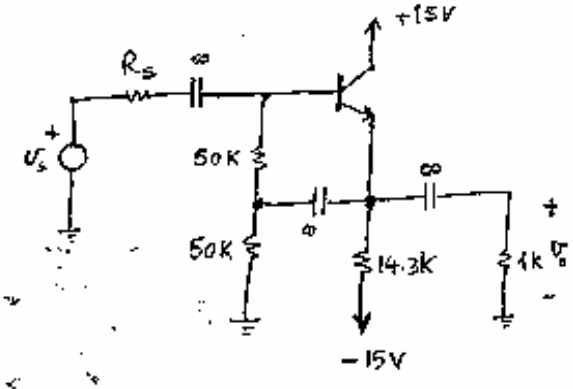

Figure 4

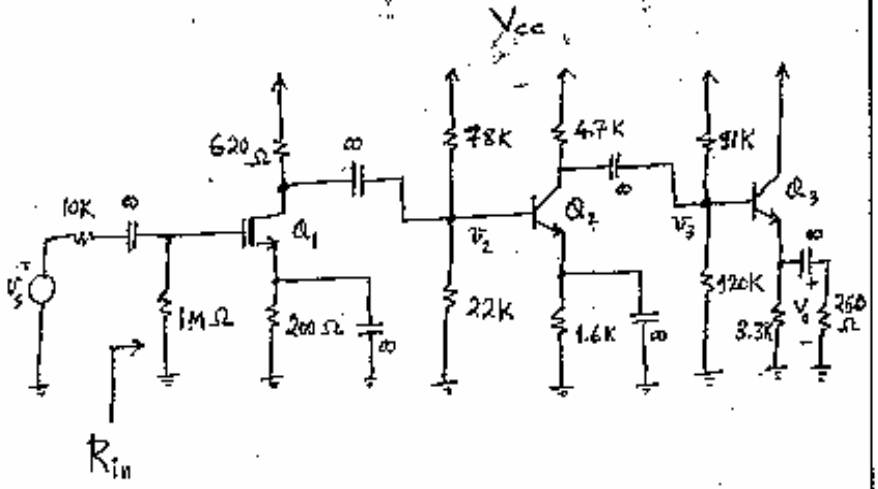

Figure 5

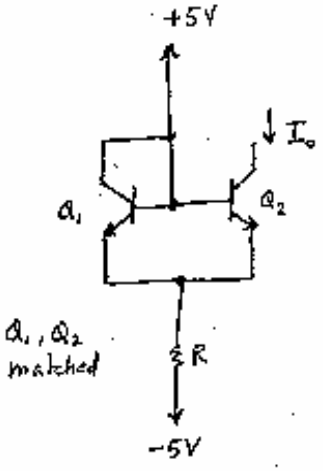

Figure 6