

Final Examination

Date: June 7th, 2016

Duration: 120 minutes

SUBJECT: Electronic Devices	
Dean of School of Electrical Engineering Signature:	Lecturer: Tran Van Su, M.Eng. Signature:
Full name: Tran Van Su	Full name: Tran Van Su

INTRODUCTIONS:

1. One note (A4 size) and calculators are allowed during the examination. Books, e-books, laptops and communications devices are prohibited.
2. Answer all questions

Question 1 (25 Marks)

The components and supply voltage of the following circuit are described as follows: $V_{CC} = 12V$, $R_i = 500\ \Omega$, $R_B = 3.3\ K\Omega$, $R_C = 5.6\ K\Omega$, $R_L = 2.2\ K\Omega$, and $\beta = 100$.

- Determine quiescent point of transistor Q. **(5 Marks)**
- Plot the small AC-signal equivalent circuit. **(5 Marks)**
- Determine input impedance R_{in} and output impedance R_o . **(5 Marks)**
- Determine the voltage gain $A_v = v_o/v_i$. **(10 Marks)**

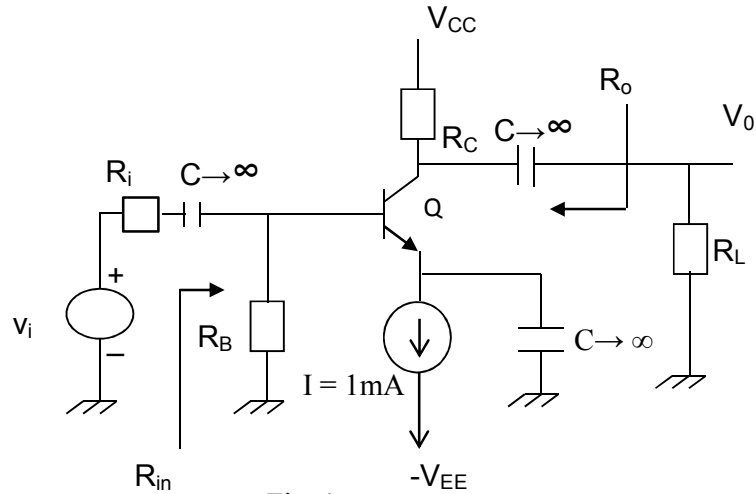


Fig. 1

Question 2 (25 Marks)

The circuit shown in Fig. 2 has $V_{CC} = 12\ V$, $R_b = 10\ k\Omega$, $R_s = 200\ \Omega$, $\beta = 100$, and early voltage $V_A = 50v$.

- Sketch the small AC-signal equivalent circuit. **(5 Marks)**
- Determine the voltage gain $A_v = v_o/v_i$ if $R_L = 2.2\ k\Omega$. **(5 Marks)**
- Determine R_L to obtain $R_{in} > 100\ k\Omega$. **(10 Marks)**
- Determine R_b to obtain $V_{CEQ} = 13.1\ V$. **(5 Marks)**

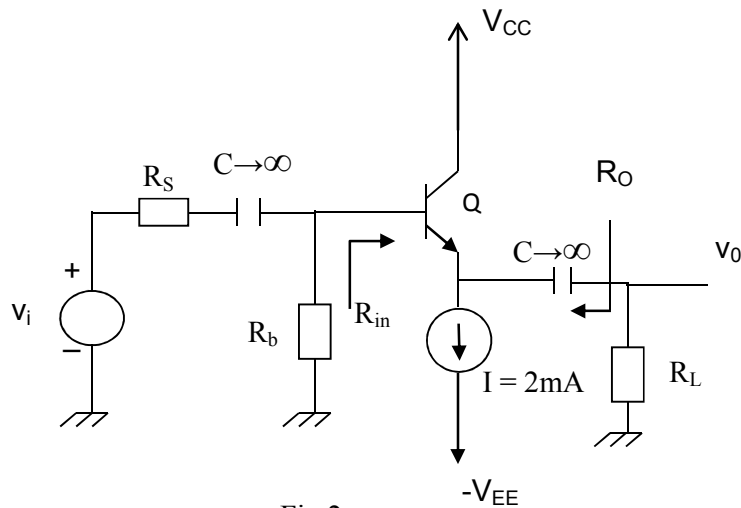


Fig.2

Question 3 (25 Marks)

$V_{DD} = 15\text{ V}$, $R_G = 560\text{ K}\Omega$, $R_{Sig} = 2\text{ K}\Omega$, $R_L = 2\text{ K}\Omega$, $V_t = 1\text{ V}$, and $\mu_n C_{ox} \frac{W}{L} = 1.5\text{ mA/V}^2$.

- Compute V_{GS} and V_S . (5 Marks)
- Plot the small AC-signal equivalent circuit. (5 Marks)
- Find R_D to obtain $V_D = 10\text{ V}$. (5 Marks)
- Determine $A_V = v_o/v_{sig}$ (5 Marks)
- What are the input and output impedances R_{in} and R_o . (5 Marks)

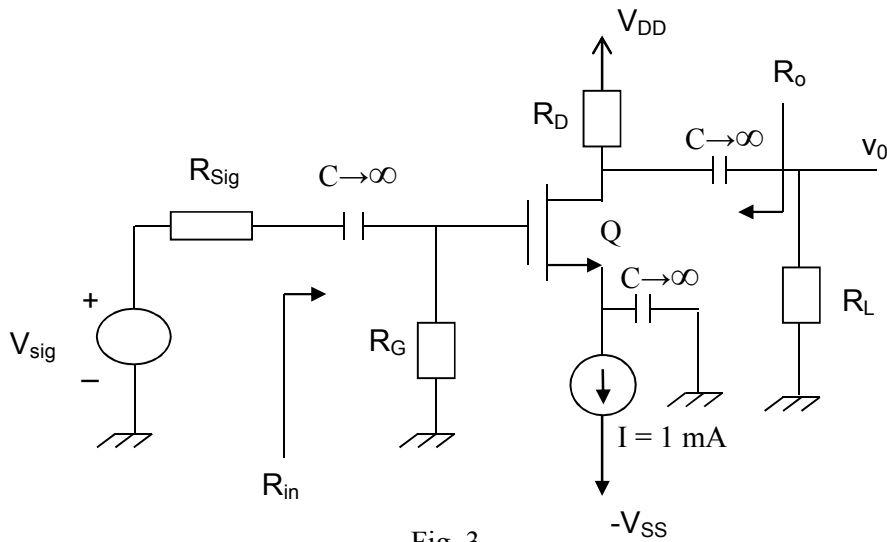


Fig. 3

Question 4 (25 Marks)

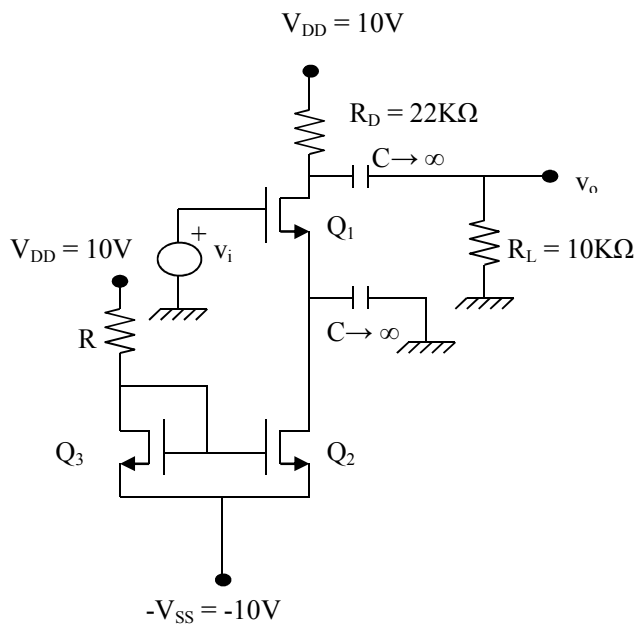


Fig. 4

Let Q_1 , Q_2 , and Q_3 be identical NMOS transistors with threshold voltage $V_t = 2\text{ V}$, $k'_n = 20\mu\text{A/V}^2$, $L = 10\mu\text{m}$, $W = 100\mu\text{m}$.

- Determine V_{GS} of Transistor Q_3 if the drain current of Q_3 is 0.2 mA . (5 Marks)
- Determine R to establish the current of 0.2 mA in Q_3 (5 Marks)
- Plot the small ac-signal equivalent circuit. (5 Marks)
- Compute the voltage gain v_o/v_i . (10 Marks)