INTERNATINONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY – HCMC

Final Examination

Date: Jan. 18th, 2017

Duration: 120 minutes

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

Fig. 1 shows the amplifier circuit with $V_{CC} = 10V$, $R_i = 200\ \Omega$, $R_1 = 9.6\ K\Omega$, $R_2 = 2.2\ k\Omega$, $R_C = 4.2\ k\Omega$, $R_E = 1k\Omega$, $R_L = 2.2\ k\Omega$, and $\beta = 100$.

a. Determine I_{CQ} and V_{CEQ} of the transistor. **(5 Marks)** $I_C = 1.14$, $V_{CE} = 4.072$
b. Plot the small AC-signal equivalent circuit. **(5 Marks)**
c. Determine input impedance R_{in} and output impedance R_o. **(5 Marks)** $R_{in} = 990$; $R_o = R_C$
d. Determine the voltage gain $A_v = v_0/v_i$. **(5 Marks)** -54.77
e. Determine the current gain $A_i = i_L/i_i$ **(5 Marks)** ~~-65176.65~~ -29.63

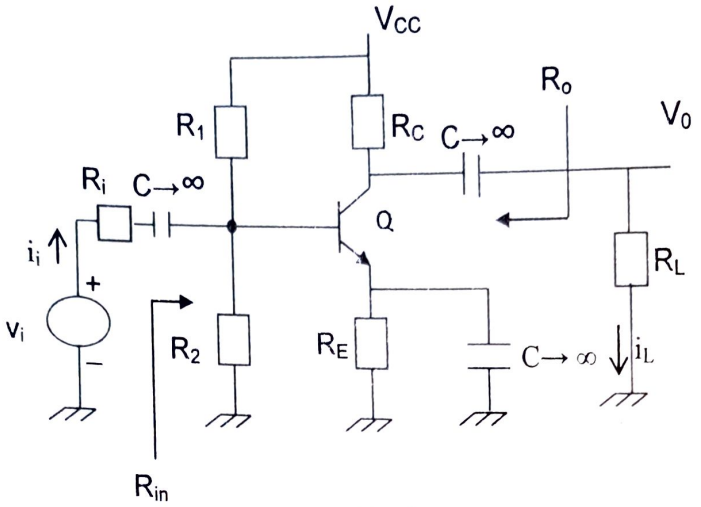

Fig. 1

Question 2 (25 Marks)

Fig. 2 shows the transistor circuit which has $V_{CC} = 10\ V$, $R_S = 1k\Omega$, $\beta = 100$, and early voltage $V_A = 80v$.

a. If $V_{CEQ} = 10.79V$ calculate R_b. (Hint: $V_{CEQ} = V_C - V_{EQ}$ and $V_{BE} = 0.7V$) **(5 Marks)** $R_b = 909\ \Omega$
b. If $R_b = 30k\Omega$ compute V_{CEQ}. **(5 Marks)** $V_{CEQ} = 10.997$
c. Determine the voltage gain $A_V = v_o/v_i$ if $R_L = 4.2\ k\Omega$. **(5 Marks)**
d. Determine R_L to obtain $R_{in} \geq 120\ k\Omega$. **(10 Marks)** $R_L > 1180.28$

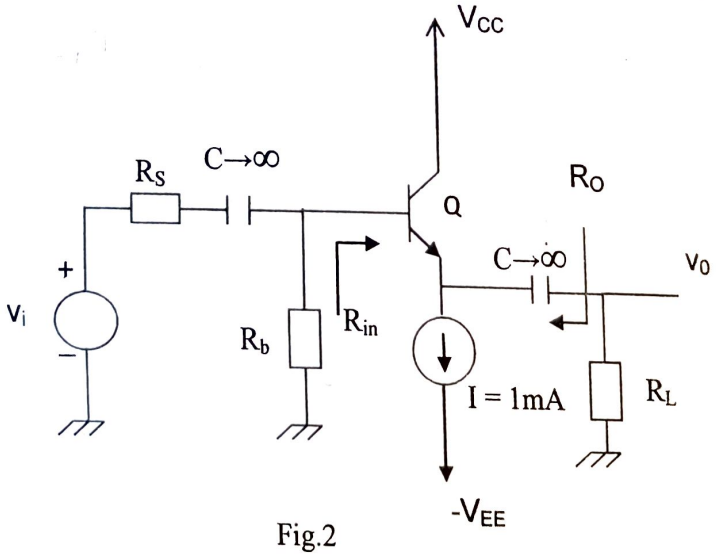

Fig.2

Question 3 (25 Marks)

$V_{DD} = 12$ V, $R_G = 470$ KΩ, $R_{Sig} = 50$ KΩ, $R_L = 2.2$ KΩ, $V_t = 1$V, and $\mu_n C_{ox} \frac{W}{L} = 2\ mA/V^2$.

a. Compute V_{GS} and V_S. **(5 Marks)** $V_{GS} = 2V$ $V_S = -2V$
b. Find R_D to obtain $V_D = 6$ V. **(5 Marks)** 6000
c. Plot the small AC-signal equivalent circuit. **(5 Marks)**
d. Determine $A_V = v_o/v_{sig}$ with the value R_D obtained in (b) **(5 Marks)** -2.91
e. Find value of R_D at which the transistor changes from saturation to triode. **(5 Marks)**

$V_{DS} < V_{GS} - V_t \Rightarrow R_D > 13000$

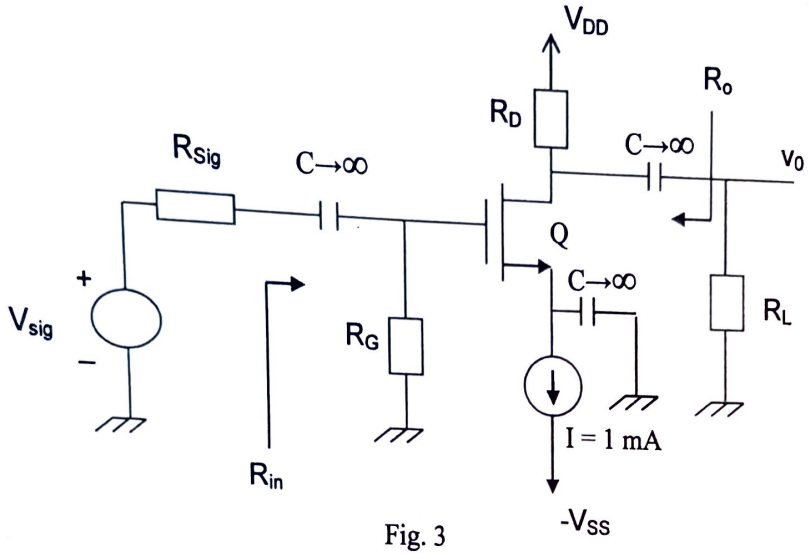

Fig. 3

Question 4 (25 Marks)

Given $V_{DD} = 12$ V, $R_1 = R_2 = 100$ KΩ, $R_D = 4$KΩ, $I_D = 1$mA

a. Find R_S to obtain V_{GS}=3V. (Hint: Find V_G, V_S) **(5 Marks)** $R_S = 3000$
b. Find V_{DS}. **(5 Marks)** 5V
c. Sketch T-model small-signal equivalent circuit. **(10 Marks)**
d. Find the voltage gain v_o/v_i if $g_m = 8$mA/V **(5 Marks)** 1.28

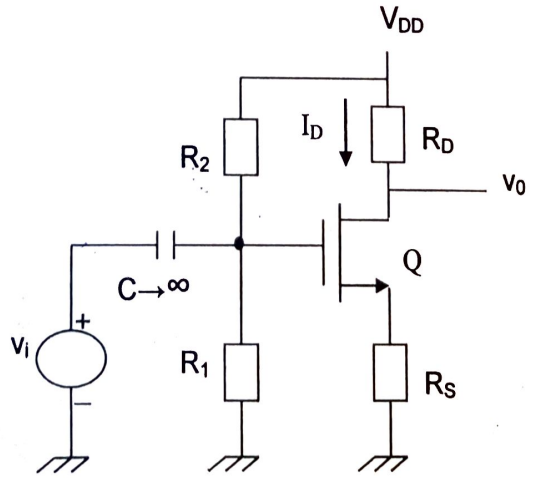

Fig. 4