THE INTERNATINONAL UNIVERSITY (IU) – VIETNAM NATIONAL UNIVERSITY – HCMC

Final Examination

Date: , 2019

Duration: 120 minutes

SUBJECT: **Analog Electronics**	
Dean of School of Electrical Engineering Signature: Full name: Mai Linh	Lecturer Signature: Full name: Tran Van Su

INTRODUCTIONS:

1. Notes and Lecture notes can be used. All communication devices such as cell phones and laptops are prohibited.
2. Answer all questions

Question 1 ***(20 marks)***

For Figure 1, given $R_{i1} = 1\ [M\Omega]$, $r_{o1} = 1\ [k\Omega]$, $R_{i2} = 1\ [k\Omega]$, $r_{o2} = 500\ [\Omega]$, $R_f = 10\ [k\Omega]$, $R_1 = 1\ [k\Omega]$.

a. What is the feedback topology? *(2 marks)*

b. Find the feedback factor β *(2 marks)*

c. Determine the open loop gain $A = \frac{v_0}{v_{i1}}$ (Assume $R_f \gg r_{o2}$) *(4 marks)*

d. Find the closed – loop gain $A_{v_f} = \frac{v_0}{v_s}$ *(4 marks)*

e. What is the input impedance R_{if} *(2 marks)*

f. What is the output impedance R_{of} *(2 marks)*

g. If $\frac{dA}{A}$ is 0.1, what is $\frac{dA_{v_f}}{A_{v_f}}$ *(2 marks)*

h. Why do we call this circuit negative feedback *(2 marks)*

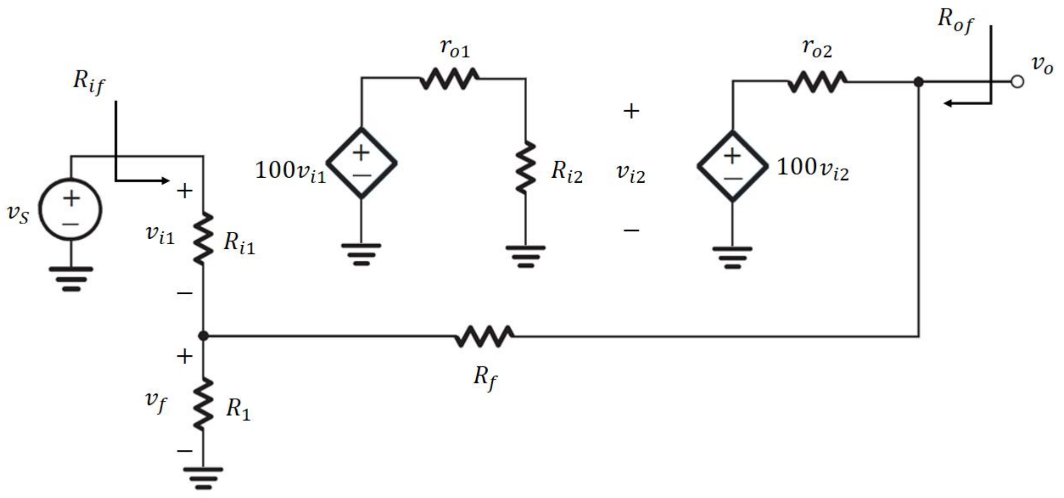

Figure 1

Question 2 ***(20 marks)***

For Figure 2, we assume that the amplifier is designed optimum with $v_{Opeak} = 21.8\ [V]$, $R_L = 500\ [\Omega]$

a. What is the signal power (P_{AC}) in the R_L *(4 marks)*

b. What is the value of V_{CC} *(3 marks)*

c. Determine I with $V_{CEsat} = 0.2\ [V]$ *(3 marks)*

d. What is the power efficiency of the circuit *(3 marks)*

e. Determine R *(3 marks)*

f. When $v_o = 10\ [V]$, calculate i_{E1} *(4 marks)*

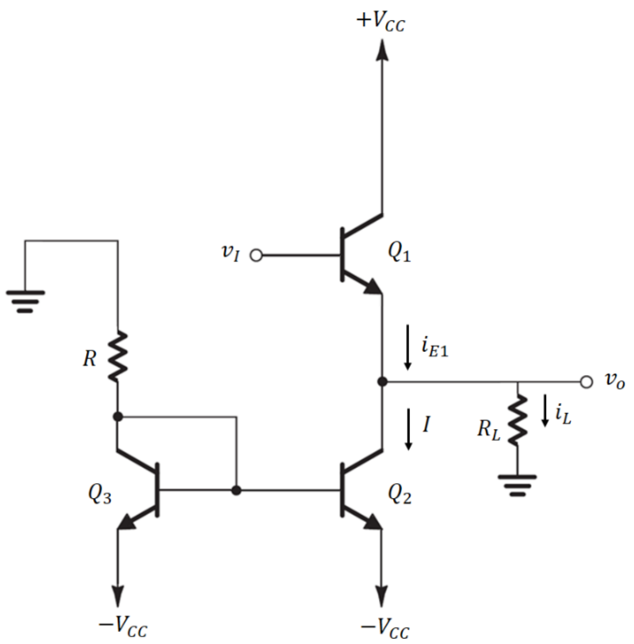

Figure 2

Question 3 ***(15 marks)***

For Figure 3, given that $C = 10\ [nF]$, $R_1 = R_2 = R_3 = R_5 = 1\ [k\Omega]$ and

$$\frac{V_0}{I} = \frac{s/C}{s^2 + \frac{s}{RC} + \frac{1}{LC}}$$

a. Determine L to obtain the resonant frequency of $100\ [KHz]$. *(4 marks)*

b. Calculate C_4 of the antoniou circuit. *(4 marks)*

c. Determine R to obtain the bandwidth of $20\ [KHz]$. *(4 marks)*

d. Find $\left|\frac{V_0}{I}\right|$ at resonant frequency. *(3 marks)*

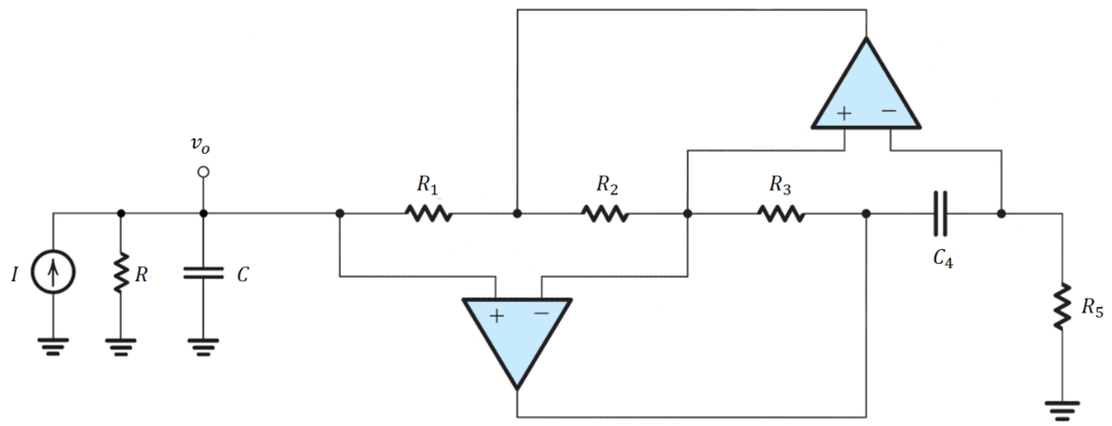

Figure 3

Question 4 ***(15 marks)***

For Figure 4, given $R = 4\ [k\Omega]$, $C = 10\ [n\text{F}]$, $C_1 = 0.1\ [\mu F]$. The circuit is a low pass filter.

a. Determine $3dB$ – cutoff frequency of the circuit

(5 marks)

b. Determine T_C to obtain $1\ [k\Omega]$ equivalent resistance of the switched capacitor circuit.

(5 marks)

c. Plot bode plot of the circuit.

(5 marks)

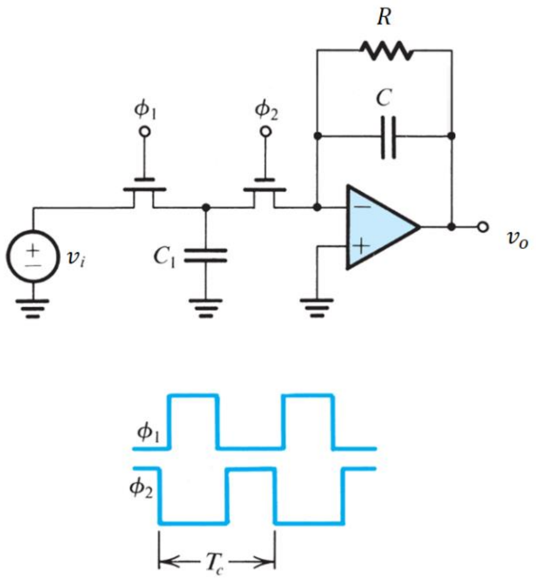

Figure 4

Question 5 ***(15 marks)***

For Figure 5, given $R_1 = R_2 = 1\ [k\Omega]$, $R_3 = 3\ [k\Omega]$ and $R_4 = 1\ [k\Omega]$. Find C_1 and C_2 to obtain the oscillating frequency of $10\ [KHz]$.

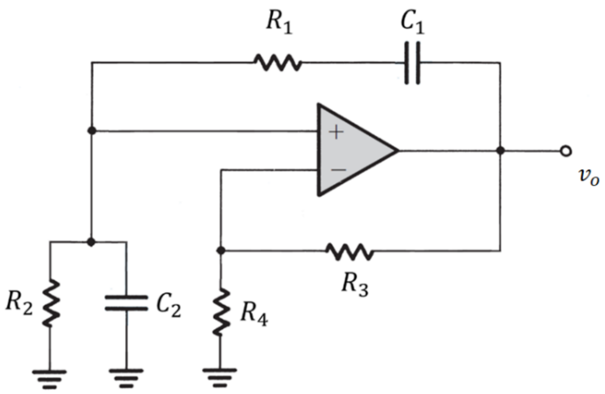

Figure 5

Question 6 ***(15 marks)***

For Figure 6, given $R = 10\ [k\Omega]$ and $C = 0.1\ [\mu F]$.

a. If $R_1 = 1\ [k\Omega]$, $R_2 = 3\ [k\Omega]$, calculate the oscillating frequency. *(8 marks)*

b. If oscillating frequency $f = 1.2\ [kHz]$ and $R_2 = 4\ [k\Omega]$, determine R_1. *(7 marks)*

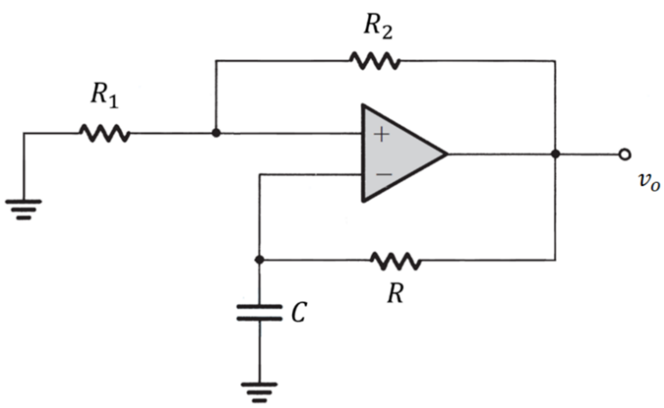

Figure 6

The End