

EE3110 Electronic Circuits**Tutorial – Oscillator 2**

Name: _____ Student Number: _____ Date: _____

1. Figure 1(a) is a Colpitts Oscillator which small signal equivalent circuit is shown in figure 1(b). Design the Colpitts oscillator so that its oscillator frequency is $f_0 = 100\text{KHz}$. Given that $r_\pi = 2.6\text{k}\Omega$, $g_m = 38.5\text{ mA/V}$. You may assume $C_1 = 0.01\mu\text{F}$ and determines C_2 , L , R_L .

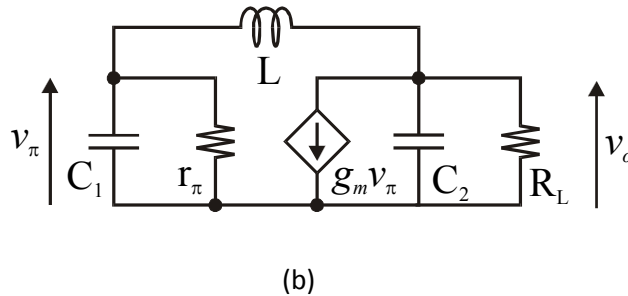
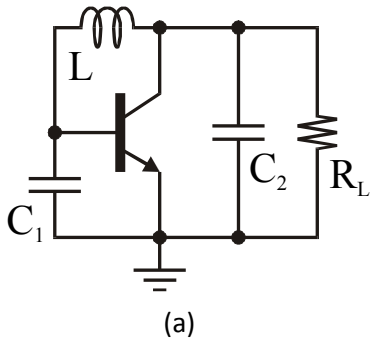


Figure 1

Hint: For large R_L , $\omega_0 = \left[\frac{C_1 + C_2}{C_1 C_2 L} \right]^{1/2} \dots (1)$ and $g_m r_\pi = \frac{C_2}{C_1} \dots (2),$

$$\text{Equ (2)} \Rightarrow C_2 = g_m r_\pi C_1 = 1.001 \mu\text{F}$$

$$\text{Equ (1)} \Rightarrow \omega_0^2 = \frac{C_1 + C_2}{C_1 C_2 L} \Rightarrow L = \frac{C_1 + C_2}{C_1 C_2 \omega_0^2}$$

$$= 0.2558 \text{ mH}$$

For R_L to be consider large, we can choose the max of the follow to cases

$$(i) R_L > 100 X_L = (100)(2\pi)(100\text{KHz})(0.2558\text{mH})$$

$$= 16\text{K}$$

$$(ii) R_L > 100 r_\pi = (100)(2.6\text{k}) = 260\text{K}$$

$\therefore R_L > 260\text{K}$ should be chosen.

2. Figure 2 is a Colpitts Oscillators which use an op-amp for providing the gain. Assume the op-amp is idea one. Derive a simplified equivalent circuit for figure 2 by replacing the A_1 by an ideal dependent voltage source with voltage gain A . The voltage output of A_1 is equal to A times the voltage across R_1 .

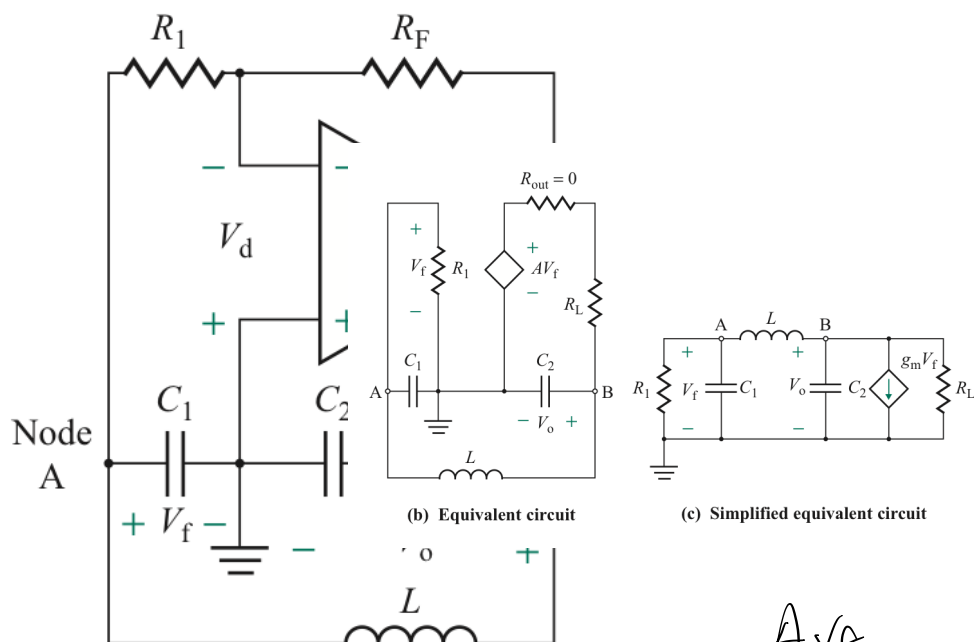
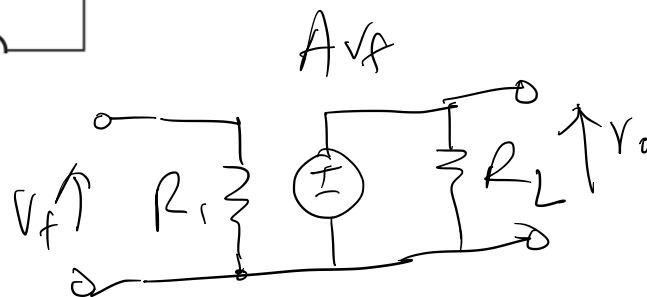


Figure 2
Equivalent model of A_1



The ac small signal model of figure 2 is

