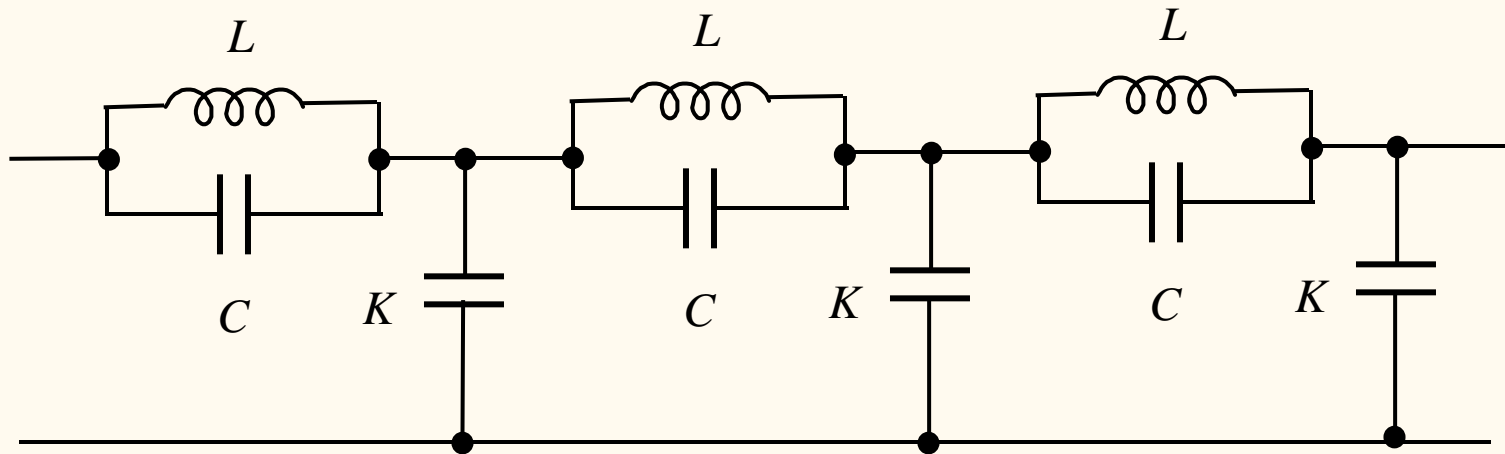


Exercise E-1

Obtain the dispersion relation in the following transmission line.



Exercise E-2

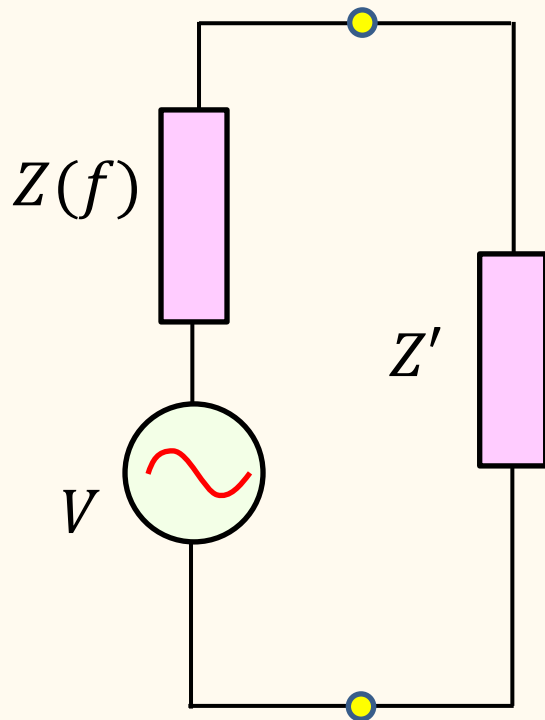
Show that the power spectrum $G(f)$ of voltage noise across the impedance

$$Z(f) = R(f) + iY(f)$$

is given as

$$G(f) = 4R(f)k_B T.$$

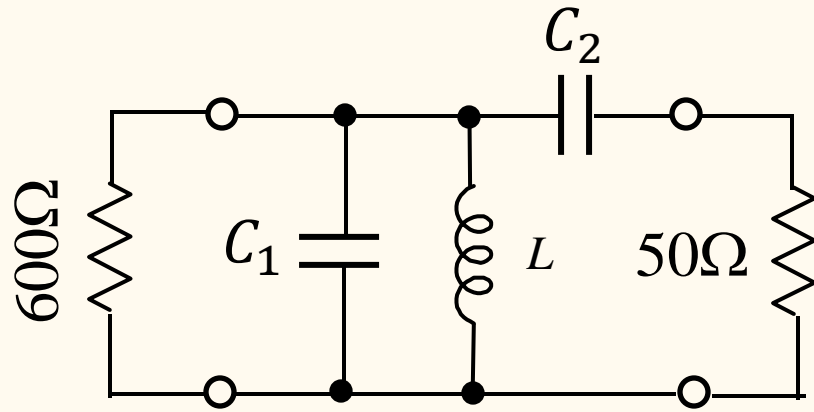
Assume that thermal noise energy per unit time is $k_B T \Delta f$.



(hint) From the above assumption we can skip the discussion on the mode energy in transmission line. Instead consider the case in the left figure, in which Z' is matched to Z as

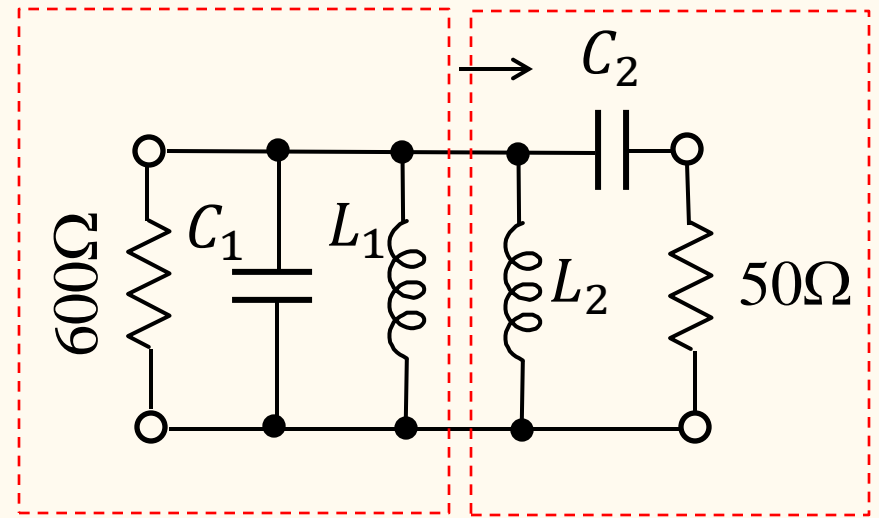
$$Z'(f) = Z^*(f) = R(f) - iY(f)$$

Exercise E-3



(a)

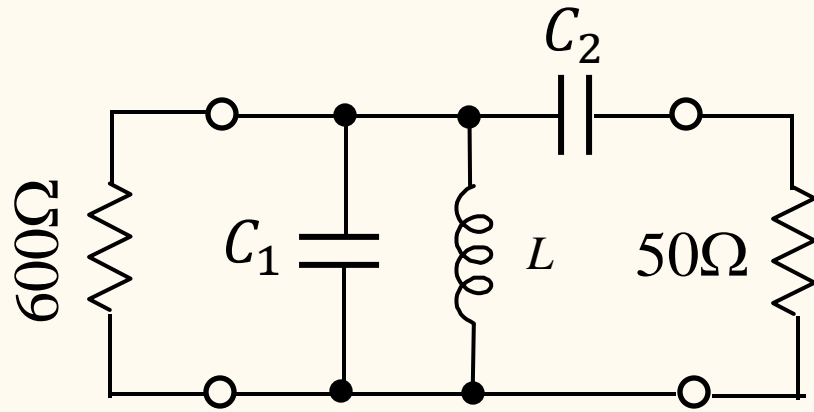
(b)



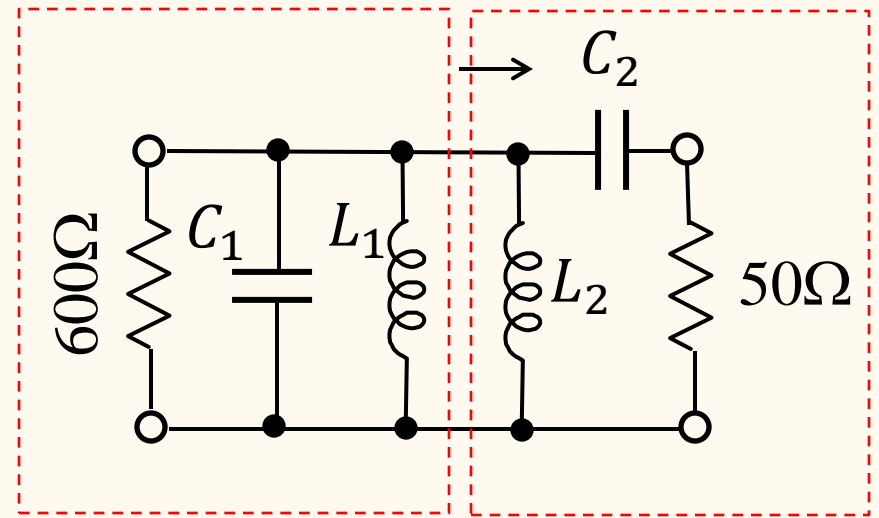
A preamplifier with FETs for an FM receiver has the output impedance of 600Ω . The FM receiver has the input impedance of 50Ω and we need to make impedance matching. The central frequency is 85MHz , the effective width of amplification is 10MHz . Obtain C_1 , C_2 , L in the matching circuit with 3 digits significant figures.

(hint) Express L with a parallel of L_1 and L_2 as shown in (b). The left resonance circuit should be tuned to 85MHz , width 10MHz . Then the left and the right circuit should be impedance matched.

Exercise E-3



(a)



(b)

FM受信機のプリアンプをFETで作ったところ、出力インピーダンスが 600Ω になった。受信機の入力インピーダンスは 50Ω なので、インピーダンスマッチを取る必要がある。中心周波数を 85MHz 、有効周波数幅を 10MHz 、として(a)のような回路でマッチを取ると、回路定数 C_1, C_2, L はどうか。有効数字3桁で答えよ。

(ヒント) (b)のようにインダクタンスを2つに分割し、左の共鳴回路で 85MHz 、 10MHz 幅に同調させる。この後、左右のインピーダンスが一致するように定数を求める。