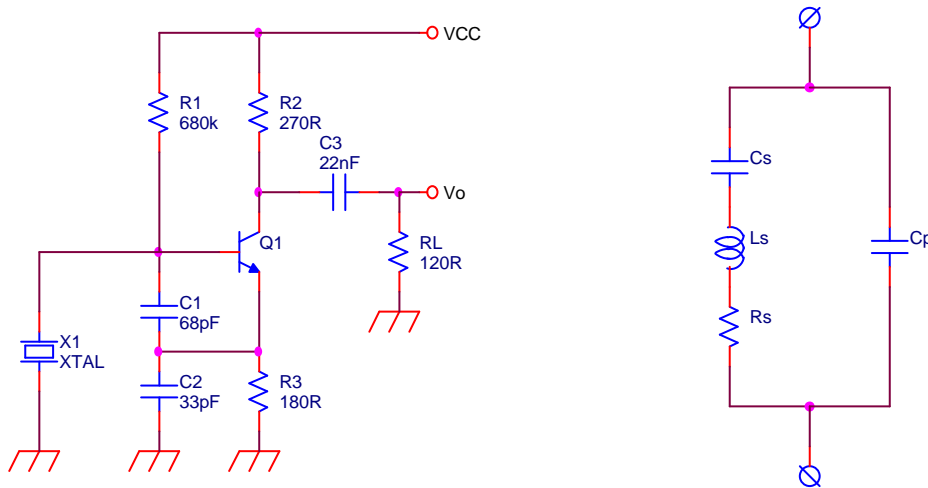


## Handout XTAL Oscillators

The schematic given below shows a crystal oscillator circuit, along with the equivalent circuit for the crystal.



DATA:  $V_{CC}=5V$ ; Q1:  $I_{CQ}=0,75mA$ ,  $V_{BE}=0,7V$ ,  $h_{FE}=125$ ,  $V_T=25mV$ ;  
 XTAL:  $C_s=0,007pF$ ,  $L_s=100,55mH$ ,  $R_s=40\Omega$ ,  $C_p=5pF$ ,  
 $f_s=5,999MHz$ ,  $f_p=6,003MHz$ ;

- 1) Draw the small-signal equivalent circuit for the oscillator, and simplify it for the frequencies of operation, explaining all assumptions made.
- 2) Compute the expression for the loop gain.
- 3) Compute the value of the oscillation frequency, deducing it from the loop gain.
- 4) Assuming 5% tolerances for C1 and C2, compute its values so that oscillator start up is ensured.