

**UNIVERSITY OF CALIFORNIA**  
**College of Engineering**  
**Department of Electrical Engineering**  
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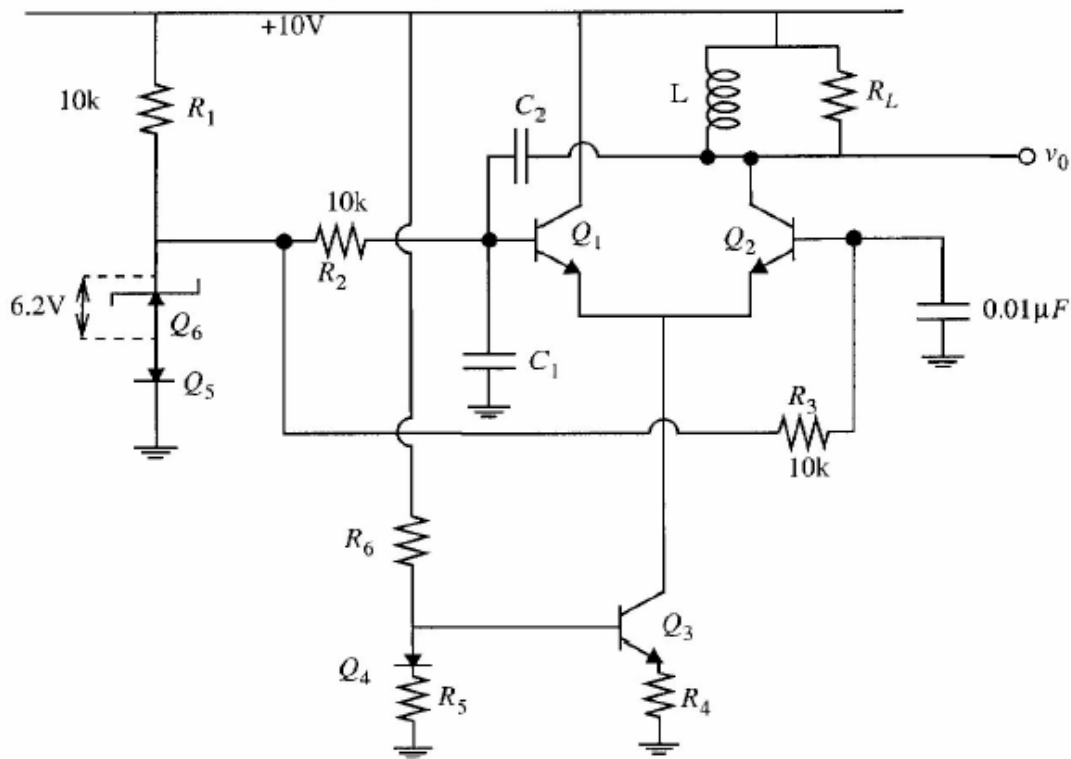
**VCO Example Problem Set**

**EECS 142**

a) Design an LC oscillator to deliver 1.5V rms to  $R_L = 1k\Omega$  at  $f_0 = 10$  MHz using the circuit shown below. Use a loaded Q of 15 and assume the unloaded coil Q is 200. Calculate  $HD_3$  and  $HD_5$  in  $v_0$ . Verify the values of  $v_0, f_0, HD_3$  and  $HD_5$  using SPICE. Examine the waveform of  $I_{C2}$  and compare with  $v_0$ .

Device data:  $C_{cs} = 1$  pF,  $C_{\mu 0} = 0.5$  pF,  $m = \frac{1}{2}$ ,  $C_{je0} = 2$  pF,  $m = \frac{1}{3}$ ,  
 $f_T = 300$  MHz at  $I_C = 2$  mA,  $\beta = 100$ ,  $I_s = 10^{-15}$  A,  $r_b = 200\Omega$ ,  $V_A = 100$  V

b) If the oscillation builds up from a small noise voltage, calculate the time taken for  $v_0$  to go from 1  $\mu$ V rms to 0.5 V rms, assuming linear operation.



All transistors have equal areas. Neglect excess phase shift in the initial design but include charge storage in SPICE. Model the Zener diode as a dc voltage source.