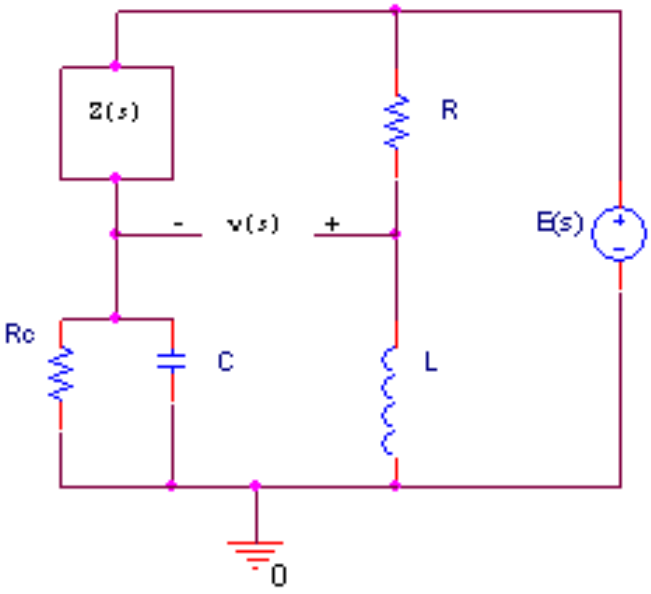
CIRCUITS – Ph.D. Qualifying Exam Spring 2009

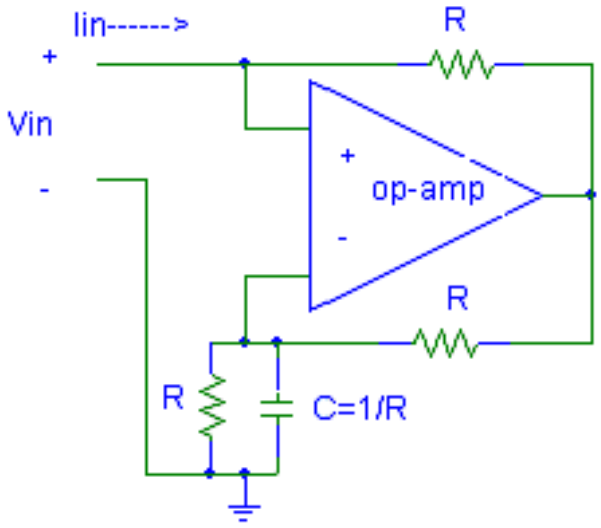
(i) (5 pts)



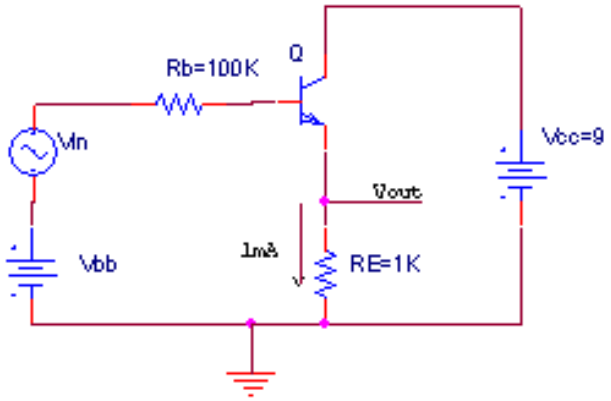
Assume that numerically R=Rc=L=1/C and give v(s) for the above bridge circuit in terms of R, Z(s) and E(s). Here $s = \sigma + j\omega$ is complex frequency.

(ii) (5 pts).

For the following circuit find the input impedance, Vin(s)/Iin(s). The op-amp is ideal (zero input currents and zero differential input voltage). Numerically C=1/R.



(iii) (5 pts)
For the following circuit find Vbb so that the bias current in RE is 1 mA.
Assume β= 99, V_T = 0.025 V = thermal voltage, V_{BE} = 0.7 V and Vin is a small AC signal. Here Rb = 100 KOhm, RE = 1 KOhm, Vcc = 9 V.



(iv) (5pts)
Find W/L needed to properly bias the transistor M in the following circuit.
Assume Threshold voltage = V_{TO} = 1.5 V, Cgs = 20 pF, Cgd = 0, $k_n = (\mu Cox/2) = 10^{-4}$ A/V^2, $I_D=k_n(W/L)(V_{GS}-V_{TO})^2$. Here the bias current in RS is 1 mA, Vgg = 4.5 V, Vdd = 9 V while Vin is a small AC signal; Rg = 100 Kohm, RS = 1 Kohm