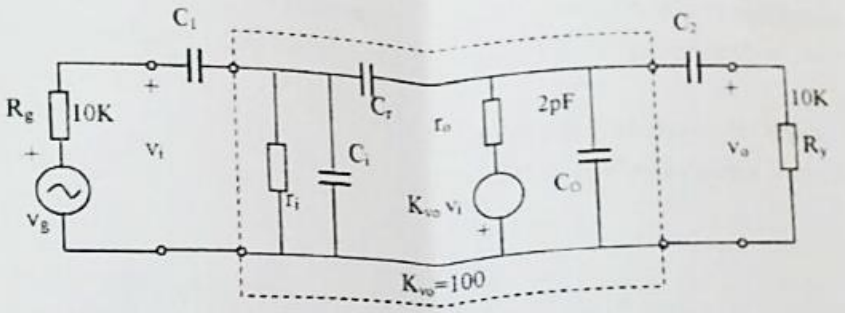
İTÜ-EEF ANALOG ELECTRONIC CIRCUITS 2014

FINAL EXAM

Dec. 29, 2014



1)- The unloaded voltage gain of a given inverting amplifier is 100, and the amplifier is driven with a voltage source with an internal impedance of R_g. The small signal model is given above:

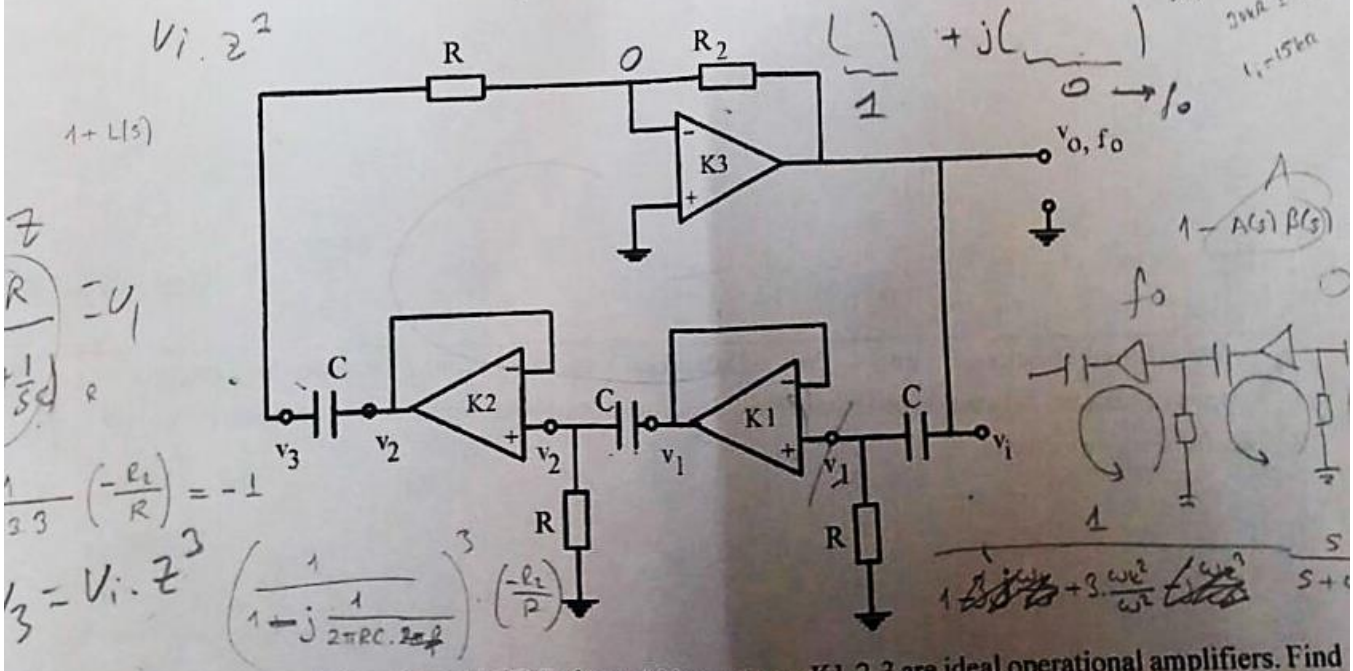
a)- At midband, the gain is measured as v_o/v_i= -100 for the unloaded circuit (Ry=∞); when R_y=10kΩ and R_g=10kΩ, we measure v_o/v_g= -48 & v_o/v_i= -80. Find the input and output resistances of the circuit (i.e., r_i and r_o)

b)- The amplifier is connected to the source and load over coupling capacitors C_1 and C_2, respectively. Find the C_1/C_2 ratio so that their associated low frequency poles coincide. Find C_1 & C_2 for a low frequency cutoff (-3dB) of f_L=70Hz.

c)- When the input is a pulse, find the maximum pulse width so that the output tilt stays less than 2%.

d)- When the input pulse has a negligible rise time, the risetime measured using a scope at the output is 726ns (Rg=10kΩ). When Rg=0Ω (t_{rg} still negligible), the output risetime drops down to 10ns. If output capacitance C_o=2pF, find C_i (amplifier input capacitance) & C_r (feedback capacitance).

Note: Miller theorem: input: (1-K)C_r, output (1-1/K) C_r; $t_r = \dfrac{0.35}{f_H}$, $t_r \approx \sqrt{t_1^2 + t_2^2 + \cdots}$



2)- The above circuit is a sinusoidal RC phase shift oscillator. K1-2-3 are ideal operational amplifiers. Find the oscilation frequency f_o as a function of RC, and also find the necessary R2 in of terms of R.

CONTINUED ON THE BACK- TURN OVER

Prof. Dr. Melih Pazarcı

İTÜ Elektrik-Elektronik Fakültesi

3)- The amplifier in the circuit below has the transfer function:

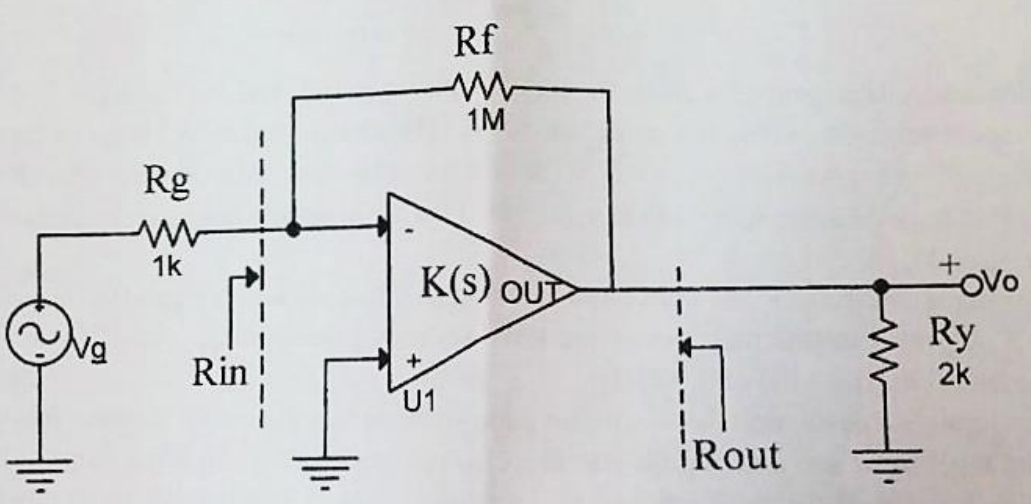
$$K(s) = \frac{V_o}{V_i} = \frac{2\pi 10^7}{(s + 2\pi 10^3)}, \quad r_{id} = 100k\Omega, \; r_o = 1k\Omega$$

a)- What is the **amplifier** gain at the low and midband frequencies.

b)- What is the feedback topology? Find the input (R_{in}) and output (R_{out}) resistances of the **circuit** (with feedback).

c)- Find the bandwidth of the **circuit** (with feedback).

d)- Find the gain of the **circuit (Vo/Vg)** (with feedback).



Points: 38 + 28 +34 = 100

Time 120".

Notes: Closed books & notes. No cellphones. You may make reasonable engineering approximations. All your approximations, roundings, and assumptions should be clearly visible. Be careful with your units.