

Electronics II

Problem sheet 4

Frequency analysis

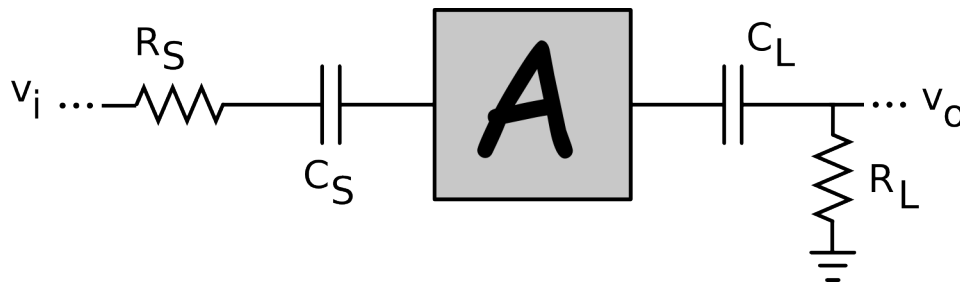
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1)

A certain commercial amplifier has the following parameters

- Voltage gain: $A = -100 \text{ V/V}$.
- Input resistance: $r_{\text{in}} = 5 \text{ k}\Omega$.
- Output resistance: $r_{\text{out}} = 1 \text{ k}\Omega$.
- Capacitance between the input and output: $C_f = 10 \text{ pF}$.
- Capacitance between the input and the box (ground) and the output and the box (ground): $C_i = C_o = 10 \text{ pF}$.

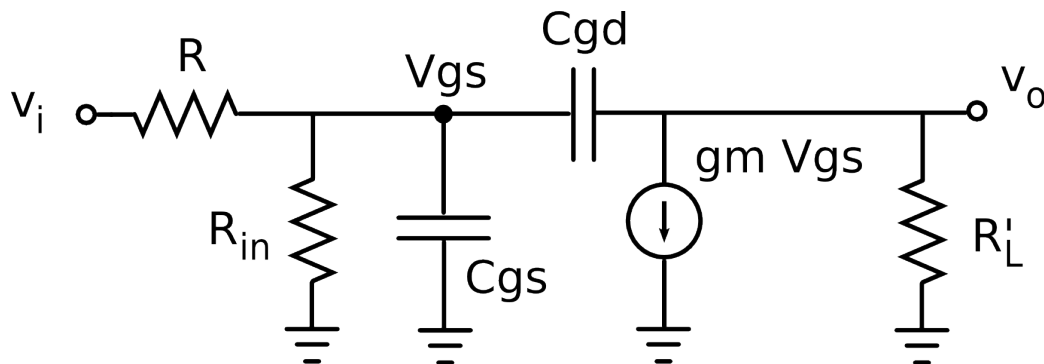
Based on this amplifier the following circuit was designed



$$R_S = 1 \text{ k}\Omega, R_L = 3 \text{ k}\Omega, C_S = C_L = 10 \text{ }\mu\text{F}.$$

- Determine the mid-frequency gain of the complete circuit.
- Schematically draw Bode plots of the behavior of the circuit in terms of frequency.
- Determine the band-width of the circuit.

2)



The figure above shows an equivalent circuit of an common-source FET amplifier. The input signal

comes from a signal generator with an output resistance R . R_{in} represents the input resistance of the FET stage and is caused by the gate-bias resistances. R_L' is the parallel equivalent resistance composed of load R_L , drain resistance R_D and FET output resistance r_o . Capacitors C_{gs} and C_{gd} are internal capacitors of the FET.

$R = 100\text{ k}\Omega$, $R_{in} = 420\text{ k}\Omega$, $C_{gs} = C_{gd} = 1\text{ pF}$, $g_m = 4\text{ mA/V}$, $R_L' = 3.33\text{ k}\Omega$.

- a) Determine the mid-band gain, $A_v = v_o/v_i$.
- b) Determine the bandwidth of the circuit.