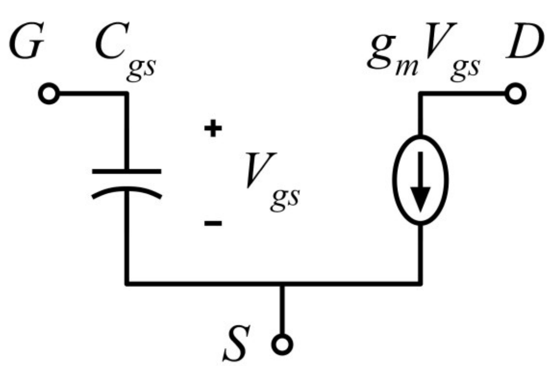
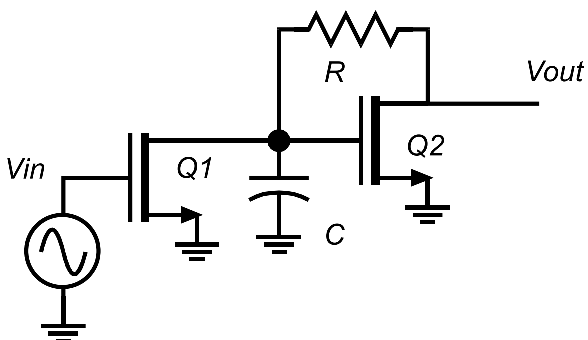


The problems below will use the following small signal model for the mosfet.

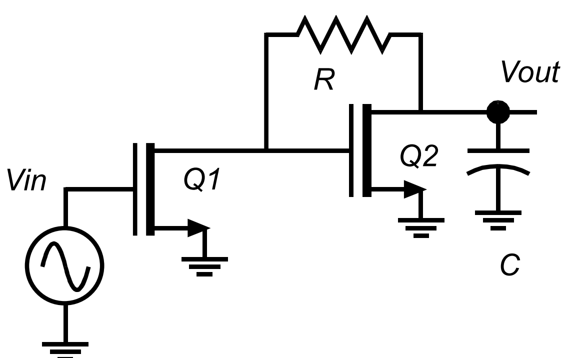


Problem 1: This is a transconductance-transimpedance amplifier. Ignore DC bias analysis. You don't need it. The two transistors have transconductance gm1 and gm2 respectively. Their output resistances Rds1 and Rds2 are both infinity. gm1=40 mS. gm2=30 mS. R=10kOhm. C=100 fF, Cgs=0 fF

a) Draw a small-signal equivalent circuit of the circuit

b) Find, by nodal analysis, a small-signal expression for Vout(s)/Vin(s)c) Find any/all pole and zero frequencies of the transfer function, in Hz:

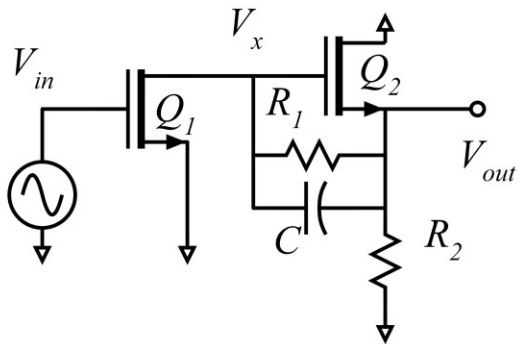
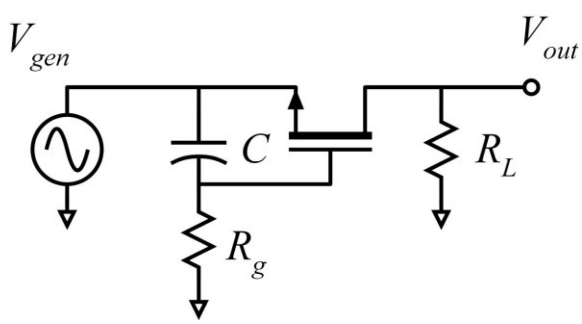
d)Draw a clean Bode Plot of Vout/Vin, LABEL AXES, LABEL all relevant gains and pole or zero frequencies, Label Slopes



Problem 2: Here again is a transconductance-transimpedance amplifier. Ignore DC bias analysis. You don't need it. The two transistors have transconductance gm1 and gm2 respectively. Their output resistances Rds1 and Rds2 are both infinity. gm1=40 mS. gm2=30 mS. R=10kOhm. C=100 fF, Cgs=0 fF (a) Draw a small-signal equivalent circuit of the circuit

b) Find, by nodal analysis, a small-signal expression for Vout(s)/Vin(s) c) Find any/all pole and zero frequencies of the transfer function, in Hz:

d)Draw a clean Bode Plot of Vout/Vin, LABEL AXES, LABEL all relevant gains

	and pole or zero frequencies, Label Slopes
 Problem 3: Ignore DC bias analysis. You don't need it. The FETs have lambda=0 hence Gds=0. further, Cgs=Cgd=0 fF. But, C, R1, R2 are all nonzero (a) Replacing the transistors with high frequency small-signal model, draw a small-signal equivalent circuit diagram.	(b) USING NODAL ANALYSIS, compute Vout(s)/Vin(s) in ratio-of-polynomials form $V_{out}(s)/V_{in}(s) =$ $A_{v,mid-band} \times (s\tau)^m \times \frac{1+b_1 s + b_2 s^2 + ...}{1+a_1 s + a_2 s^2 + ...}$ here m, an integer, can be positive or negative or zero. (c) g_{m1} =10 mS. g_{m2} =5 mS R_1 =10 kOhm, R_2 =20 kOhm, C=0.1pF Find the frequencies of any zeros (there may be zero, one or two present) in Vout(s)/Vin(s): (d) Find any/all pole and zero frequencies of the transfer function, in Hz: Draw a clean Bode Plot on semilog paper of Vout/Vin, LABEL AXES, LABEL all relevant gains and pole or zero frequencies, Label Slopes (d) Vin(t) is a 100 mV amplitude step-function Find Vout(t), and plot it below. Label axes, show initial and final values, show time constants
	Problem 4: Ignore DC bias analysis. You don't need it. The transistor has transconductance gm. Its output resistance Rds is infinity. (a) Draw a small-signal equivalent circuit of the circuit. (b) gm=1 mS. C=10 pF. . Find, by nodal analysis, a small-signal expression for Vout(s)/Vin(s) (c) Find any/all pole and zero frequencies of the transfer function, in Hz: Draw a clean Bode Plot on semilog paper of Vout/Vin, LABEL AXES, LABEL all relevant gains and pole or zero frequencies, Label Slopes (d) Vin(t) is a 100 mV amplitude step-function Find Vout(t), and plot it below. Label axes, show initial and final values, show time constants

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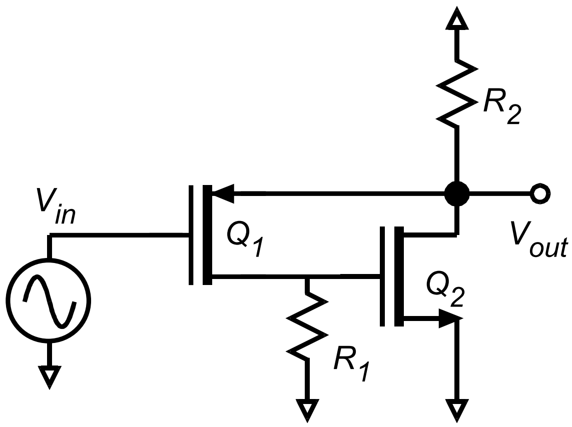
<td>
</td>
<td>Problem 5: Ignore DC bias analysis. You don't need it. The two transistors have transconductance gm1 and gm2 respectively. Their drain-source resistances Rds1 and Rds2 are both infinity. (a) Draw a small-signal equivalent circuit of the circuit (t) Find, by nodal analysis, a small-signal expression for Vout/Vin</td>
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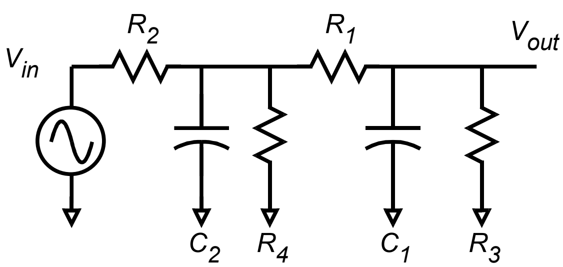
<td>
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<td>Problem 6: R1=1 KOhm, R2=4kOhm, R3=6kOhm, R4=8 kOhm, C1= 1 fF C2=2 fF
Using Nodal analysis , find the transfer function Vout(s)/Vgen(s). Give the answer in standard form
$$\frac{V_{out}(s)}{V_{gen}(s)} = \left.\frac{V_{out}}{V_{gen}}\right|_{DC} \frac{1+b_1 s+b_2 s^2+\ldots}{1+a_1 s+a_2 s^2+\ldots}$$</td>
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