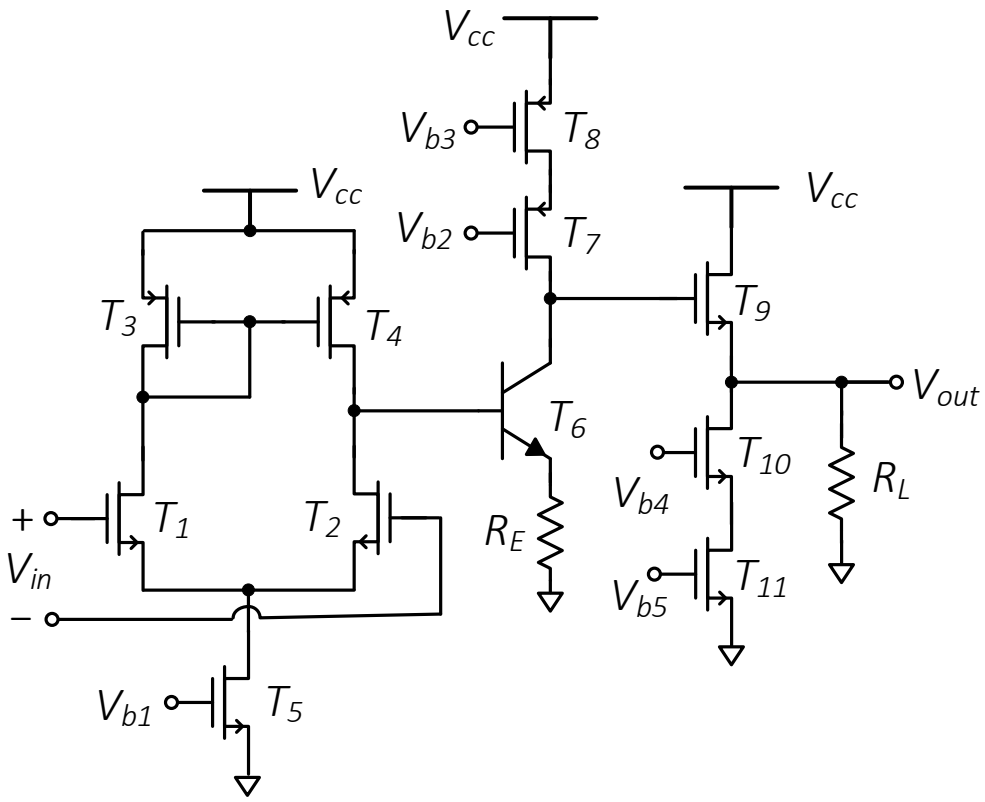
EHB 262E Final Exam **Problem-2 (35minutes)** UPLOAD till 19.05!

Group 1 (Student last number: 0,1,2,3) (G2 and G3 problems are in the next pages)

For the amplifier below, $g_{m,npn} = 10\ mS$, $g_{m,nmos} = 5\ mS$, $g_{m,pmos} = 1\ mS$, $R_E = 100\ \Omega$, $R_L = 1\ k\Omega$, $r_{o,npn} = 50\ k\Omega$, $r_{o,nmos} = 5\ k\Omega$, $r_{o,pmos} = 10\ k\Omega$, and $\beta = 100$ are given. Assume that MOSFETs operate in the saturation region and the BJT is in the forward-active region, where V_{B1} through V_{B5} are DC biasing voltages.

a. Find the mid-band voltage gain expression $A_V = V_{out}/V_{in}$ of the amplifier, and calculate it in dB.
b. How would you improve the CMRR of this amplifier? Suggest a modification in the circuit topology, and calculate (approximately) the factor of improvement of your proposal.



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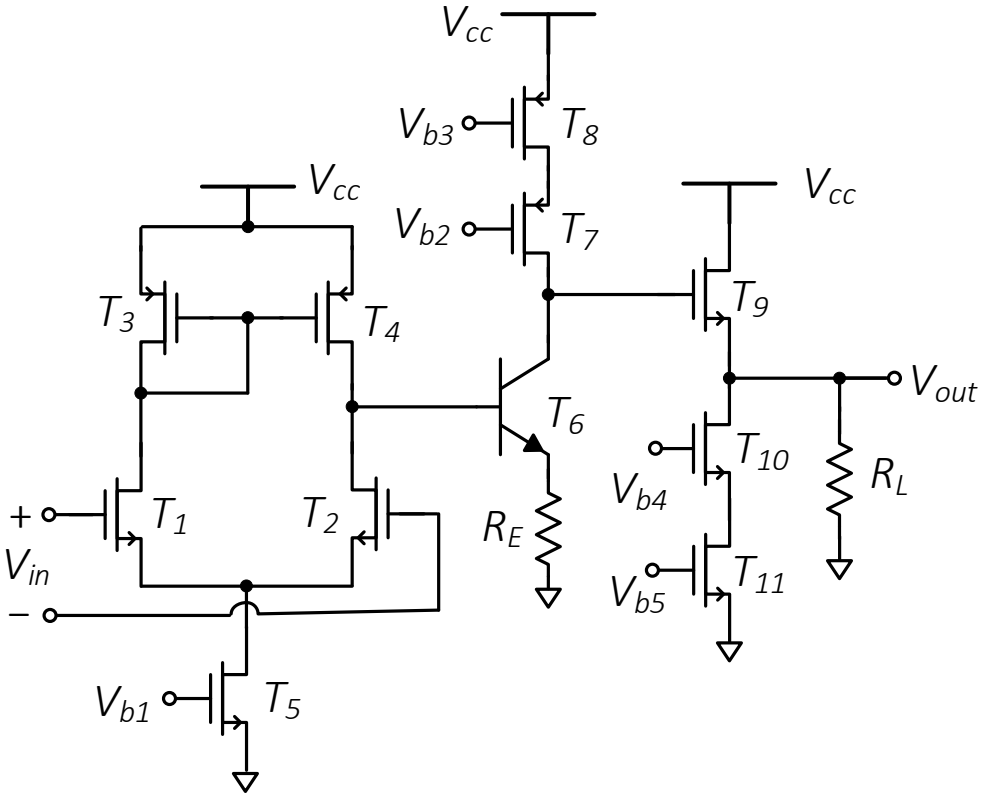
Group 2 (Student last number: 4,5,6) (G3 problem is in the next page)

For the amplifier below, $g_{m,npn} = 20\ mS$, $g_{m,nmos} = 10\ mS$, $g_{m,pmos} = 2\ mS$, $R_E = 100\ \Omega$, $R_L = 2\ k\Omega$, $r_{o,npn} = 60\ k\Omega$, $r_{o,nmos} = 8\ k\Omega$, $r_{o,pmos} = 12\ k\Omega$, and $\beta = 100$ are given. Assume that MOSFETs operate in the saturation region and the BJT is in the forward-active region, where V_{B1} through V_{B5} are DC biasing voltages.

a. Find the mid-band voltage gain expression $A_V = V_{out}/V_{in}$ of the amplifier, and calculate it in dB.
b. How would you improve the CMRR of this amplifier? Suggest a modification in the circuit topology, and calculate (approximately) the factor of improvement of your proposal.



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Group 3 (Student last number: 7,8,9)

For the amplifier below, $g_{m,npn} = 15\ mS$, $g_{m,nmos} = 8\ mS$, $g_{m,pmos} = 1.5\ mS$, $R_E = 100\ \Omega$, $R_L = 2\ k\Omega$, $r_{o,npn} = 55\ k\Omega$, $r_{o,nmos} = 6\ k\Omega$, $r_{o,pmos} = 11\ k\Omega$, and $\beta = 100$ are given. Assume that MOSFETs operate in the saturation region and the BJT is in the forward-active region, where V_{B1} through V_{B5} are DC biasing voltages.

a. Find the mid-band voltage gain expression $A_V = V_{out}/V_{in}$ of the amplifier, and calculate it in dB.
b. How would you improve the CMRR of this amplifier? Suggest a modification in the circuit topology, and calculate (approximately) the factor of improvement of your proposal.