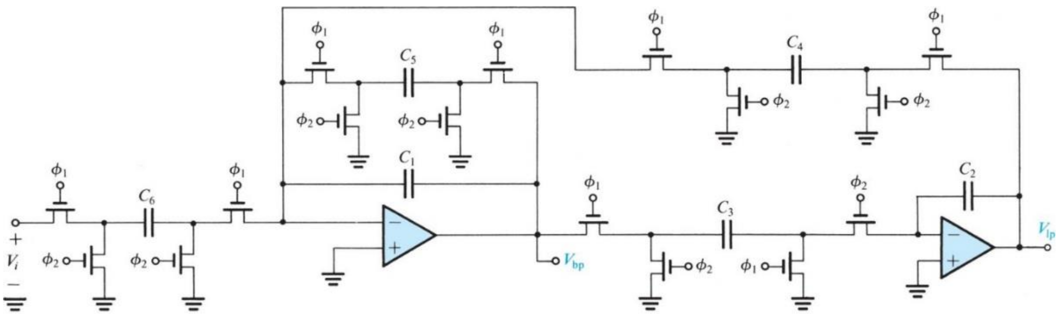
*Choose one of the two problems below for your term project for HSPICE simulation.
*10:00 am, Jan 22nd at Rm 623 to present in ppt and turn in with HSPICE simulation results.
*15 extra points max for one problem. DO NOT do/present two problems.

*Use 0.18 process file

1. Design the circuit of a two-integrator-loop, active–RC biquad in switched-capacitors below. At the output of the second (noninverting) integrator, a maximally flat low-pass function with $\omega_{3dB} = 10^3$ rad/s and unity dc gain. Use a clock frequency $f_c = 100$ kHz and select $C_1 = C_2 = 5$ pF.
   (i) Determine the values of C_3, C_4, C_5, and C_6. (Hint: For a maximally flat response, $Q = 1/\mathrm{sqrt}(2)$ and $\omega_{3dB} = \omega_0$)
   (ii) Conduct HSPICE simulation using a non-ideal op designed by yourself to adjust values of Cs for achieving the same specs of the given filter.

   Hints: (1) Use an ideal clock in HSPICE to drive $_1$ and ϕ_2.
   (2) The designed C_3, C_4, C_5, and C_6 need to be adjusted further for part (ii) to achieve $\omega_{3dB} = 10^3$ rad/s and $f_c = 100$ kHz exactly.



2. Design the Wien-bridge oscillator below (determine all Cs and Rs) to offer an oscillating frequency as close possible as to 10 kHz, and use HSPICE to verify your results. Use a non-perfect op designed by yourself.

   Hints: The designed Cs and Rs need to be re-adjusted in HSPICE simulation to overcome the imperfection of the op designed by yourself to achieve 10 kHz exactly.