R.V.COLLEGE OF ENGINEERING, Bengaluru - 59
Department of Electronics & Communication Engineering
www.rvce.edu.in ; hod.ec@rvce.edu.in ; +91-9900700990 ; 080-6717 8042

IV Semester
Re-Test - 3

Course: Analog IC Design **Course Code: 18EC46**
Time: 1.5 Hours *Max Marks: 50*

1. (a) Assuming ideal opamp, determine the transfer function of KHN biquad high pass filter. Design a KHN circuit to realize a high pass function with $f_o = 10KHz$ and $Q = 2$, assume the integrators have same resistors and capacitors, with $C = 1nF$. What is the value of high frequency gain obtained? What is the centre frequency gain of bandpass function that is simultaneously available at the output of the first integrator?

Solution:

$$\frac{V_{out}}{V_{in}}(S) = \frac{b_2 S^2}{S^2 + \frac{\omega_n}{Q}S + \omega_n^2} \quad (1M)$$

$$V_{out}(S) = b_2 V_{in}(S) - \frac{\omega_n}{Q}\frac{1}{S}V_{out}(S) - \frac{\omega_n^2}{S^2}V_{out}(S)$$

(b) fl;kajs

(M5:CO3:L3)

2. Assuming ideal opamp, determine the transfer function of KHN biquad high pass filter. Design a KHN circuit to realize a high pass function with $f_o = 10KHz$ and $Q = 2$, assume the integrators have same resistors and capacitors, with $C = 1nF$. What is the value of high frequency gain obtained? What is the centre frequency gain of bandpass function that is simultaneously available at the output of the first integrator?

(M10:CO3:L4)

3. (a) In the two-stage op-amp of Fig.a, $(W/L) = (50/0.5)$ for all transistors except for M_5, for which $(W/L)_5 = (72/0.5)$. Also, $I_{D7} = 1mA$ and the output branch is biased at $0.5mA$. Given $V_{DD} = 3V, K_n^{'} = 360\mu A/V^2, K_p^{'} = 90\mu A/V^2, \lambda_n = 0.1V^{-1}, \lambda_p = 0.1V^{-1}, V_{Tn} = 0.7V$ and $V_{Tp} = -0.8V$.
   i. Determine the CM level at nodes X and Y.
   ii. Calculate the maximum output voltage swing.
   iii. Calculate the total gain of the op-amp.

(M7:CO2:L6)

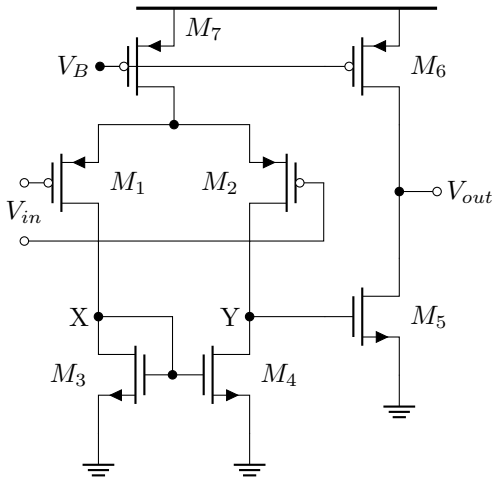

Fig.a

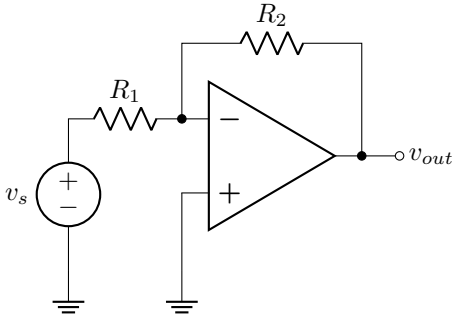

Fig.b

(b) If the above op-amp is used in a closed loop configuration (as shown in Fig.b) with $R_1 = 1k\Omega$ to achieve a closed-loop DC gain of -3, calculate the value of R_2 that is required to achieve the required closed-loop gain and the gain error that results due to finite open-loop gain.

(M3:CO3:L2)