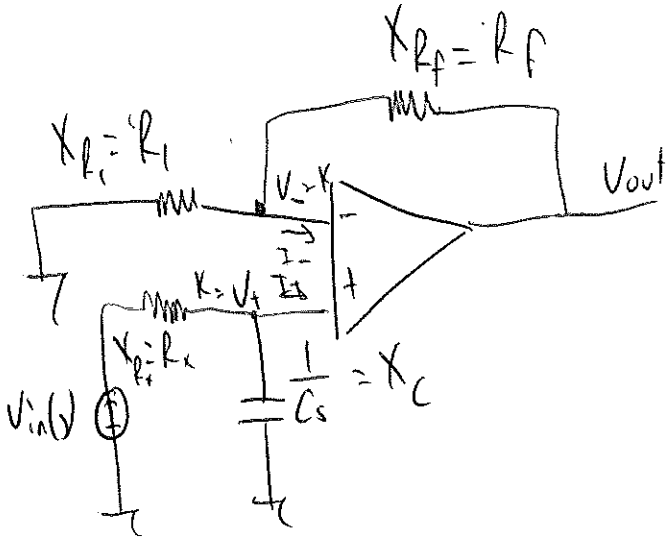
(Q1)

$$H(s) = 1000 \times \frac{1}{s+100}$$

Gidiş 8

In Laplace Domain



$$I_- = I_+ \cong 0$$

$$V_- = V_+ = K$$

$X_{R_1} = R_1$

$X_{R_f} = R_f$

$$\frac{V_{out} - K}{X_{R_f}} = \frac{K - 0}{X_{R_1}}$$

$$V_{out}(R_1) = K\left[\frac{R_1 + R_f}{R_1}\right]$$

$$\frac{V_{in} - K}{X_{R_x}} = \frac{K}{X_C}$$

$$V_{out} = K\,\frac{R_1 + R_f}{R_1} \quad * \quad \text{2 puan}$$

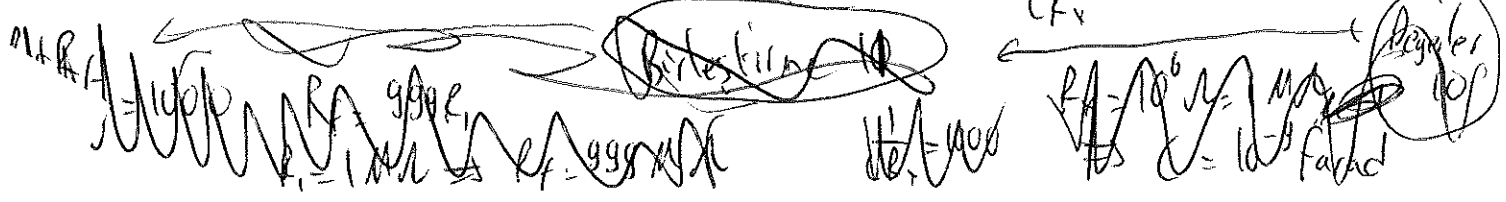
$$V_{in} X_C = K\left(X_C + X_{R_x}\right)$$

$$\frac{V_{in} X_C}{X_C + X_{R_x}} = K = \frac{V_{in}\ \frac{1}{sC}}{\frac{1}{sC} + R_x} = \frac{V_{in}}{1 + sCR_x} = K \quad ** \quad \text{2 puan}$$

* and ** together

$$\frac{V_{out}}{V_{in}} = \frac{R_1 + R_f}{R_1} \cdot \frac{1}{1 + sCR_x} = \frac{R_1 + R_f}{R_1} \cdot \frac{\frac{1}{CR_x}}{\frac{1}{CR_x} + s} = 1000 \cdot \frac{1}{s+100}$$

5 denklem



⑥ sonuçlar

$$\Rightarrow \quad \frac{R_1+R_f}{R_1}\ \frac{1}{CR_+} = 1000 \qquad \frac{1}{CR_x} = 100$$

$$\frac{R_1+R_f}{R_1} \times 100 = 1000 \qquad \frac{R_1+R_f}{R_1} = 10$$

$$R_f = 9R_1$$

if $R_1 = 1\,M\Omega \quad R_f = 9\,M\Omega$

if $R_x = 1\,M\Omega = 10^6\,\Omega \quad C = \frac{1}{100 \times R_x} = \frac{1}{10^8} F = 10 \times 10^{-9} F$

$C = 10\,nF$

10 direnç kapasitör seçimi

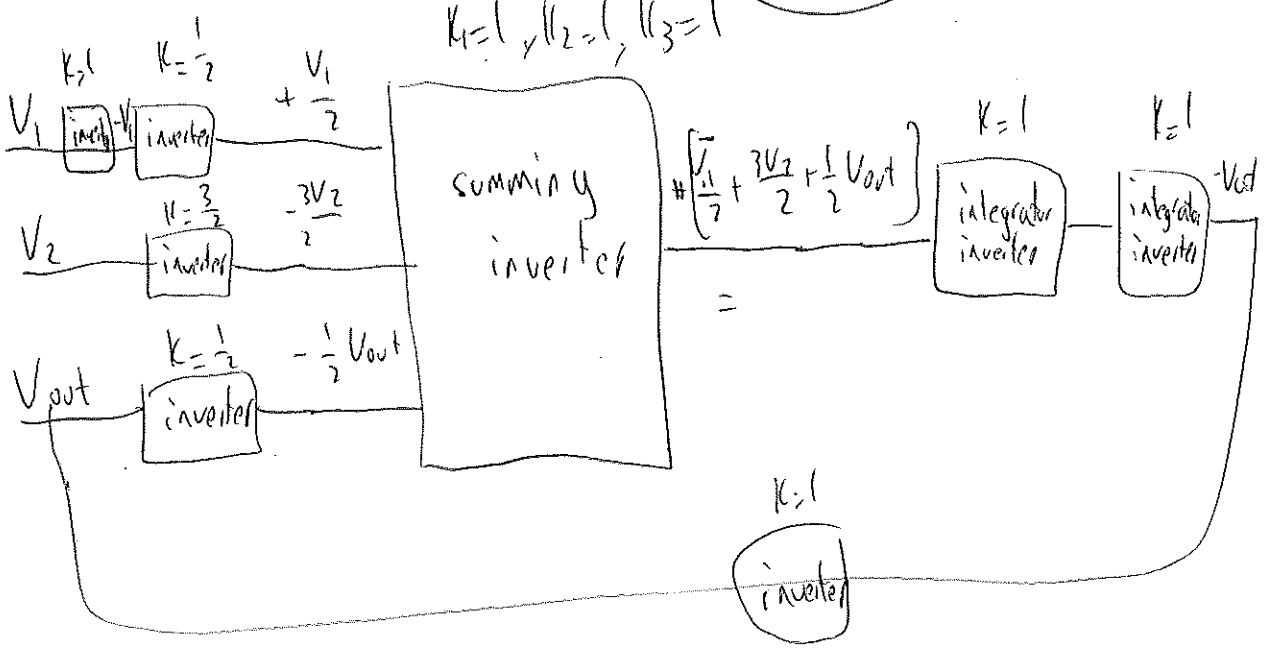
(Q2)

$$V_{out} = -2\frac{d^2}{dt^2}V_{out} + V_1 + 3V_2$$

$$2\frac{d^2}{dt^2}V_{out} = V_1 - V_{out} - 3V_2$$

$$\frac{d^2}{dt^2}V_{out} = \frac{1}{2}V_1 - \frac{1}{2}V_{out} - \frac{3}{2}V_2$$

1 puan



Gain değerleri yazılmalı 20 puan

Genel biçim 10 puan

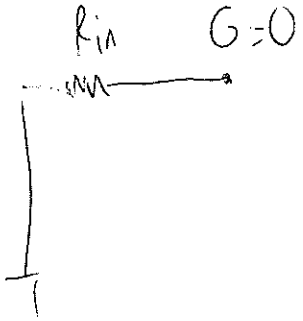
Her eksiklikte puan kırması yapılacak

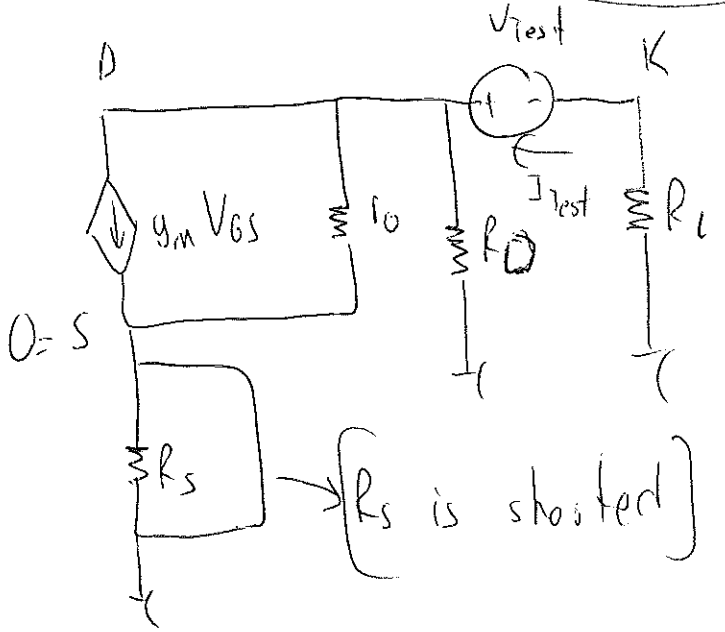
Q3 - Kill sources
- The capacitors are shorted (except for C_d)
- Put source instead of C_d (V_{test})
- Calculate current originating from the source (I_{test})

$$-\frac{V_{test}}{I_{test}} = R_{C_d}$$

$$-f_{cut-off-C_d} = \frac{1}{2\pi R_{C_d} C_d}$$

Devre 7 puan





$V_{GS} = G - S = 0$

$g_m V_{GS} = 0$

$D - K = V_{test}$

$$I_{test} = \frac{-K}{R_L}$$

$$I_{test} = g_m V_{GS} + \frac{V_D}{r_o} + \frac{V_D}{R_L} = \frac{V_D}{r_o} + \frac{V_D}{R_D} = \frac{D}{r_o \| R_D}$$

$$\frac{D}{r_o \| R_D} = -\frac{K}{R_L} = I_{test}$$

$$K = -\frac{R_L}{r_o \| R_D} D$$

$$\frac{V_{test}}{I_{test}} = \frac{D-K}{\frac{-K}{R_L}} = \frac{D + \frac{R_L}{r_o \| R_D} D}{\frac{1}{R_L} \frac{R_L}{r_o \| R_D} D}$$

$$\frac{V_{test}}{I_{test}} = R_L + (r_o \| R_D) = R_{C_D}$$

$= 1500\ \Omega$ (25 puan)

$$f_{cut-off\_C_d} = \frac{1}{2\times\pi\times\left[R_L + (r_o \| R_D)\right]\times C_d}$$

$$f_{cut-off\_C_d} = \frac{1}{2\times\pi\left[1000 + [1000\|1000]\right]\times 1\times10^{-6}} = \frac{1}{2\pi\times1500\times10^{-6}}$$

$$= \frac{10^6}{3000\times\pi} = \frac{10^3}{3\times\pi}\ Hertz$$

6 pcun

(Q4) $Closed\_loop\_gain = A_{CL} = \frac{SR}{\frac{0.5}{10}} = \frac{2}{\frac{0.5}{10}} = 40$