EE-303 : Electronics-II EXAM-II (051)
Instructor: Dr. Saad Mohammad Al-Shahrani

Name: ID #

Question # 1:

a) (2)

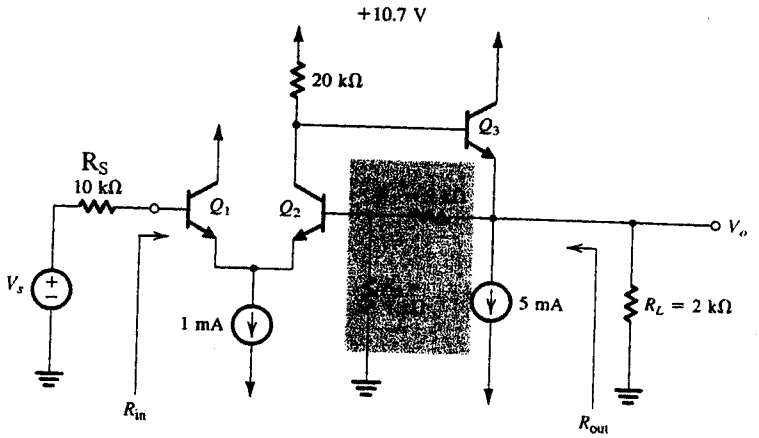
Determine the type of feedback configuration that should be used in a design to achieve the following objectives:

a) **Low** Input Resistance R_i and **Low** Output Resistance R_O..... Shunt - shunt
b) **High** Input Resistance R_i and **Low** Output Resistance R_O..... series - shunt
c) **Low** Input Resistance R_i and **High** Output Resistance R_O..... shunt - series
d) **High** Input Resistance R_i and **High** Output Resistance R_O..... series - series

b) (6)

For the amplifier circuit shown below, with **series-shunt feedback** formed by R_1 and R_2, assume all BJTs are identical with $\beta = 100$ and ignore r_o .find the **expressions** of:

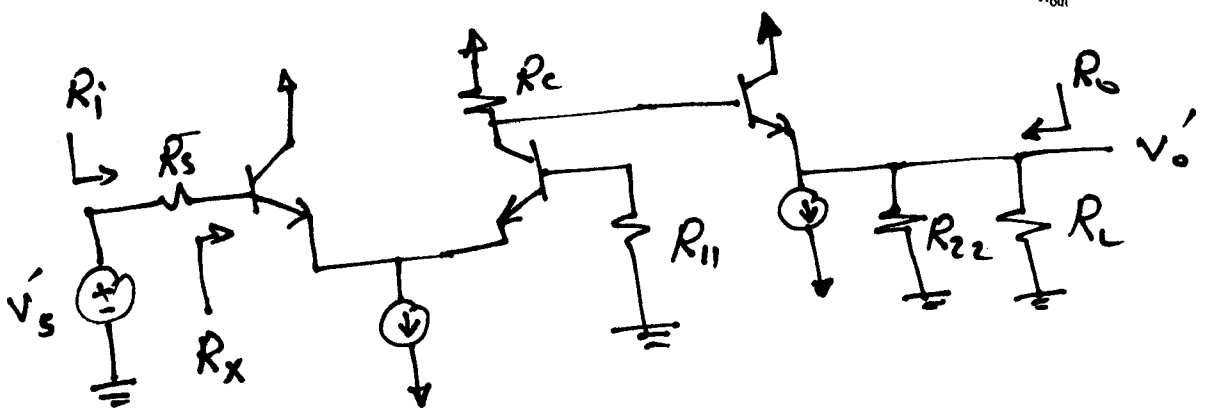
***A*, β_f, R_{in} and R_{out}**



$R_{11} = R_1 // R_2$

$R_{22} = R_2 + R_1$

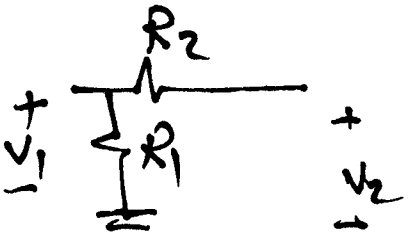
A



$$A = \frac{V_o'}{V_s'} = \frac{R_x}{R_x + R_s} \cdot \frac{-R_c // [(\beta+1)(R_{22} // R_L) + r_{\pi_3}]}{2r_{e_1}} \cdot \frac{R_L // R_{22}}{R_L // R_{22} + r_{e_3}}$$

$$R_x = 2(\beta+1) r_{e_1} + R_{11} \quad ; \quad r_{e_1} = r_{e_2}$$

$$B_f = \frac{V_1}{V_2} = \frac{R_1}{R_1 + R_2}$$



$$R_i = R_s + R_x = R_s + 2(\beta+1) r_{e1} + R_{11}$$

$$R_{if} = (1 + A\beta_f) R_i \Longrightarrow R_{in} = R_{if} - R_s$$

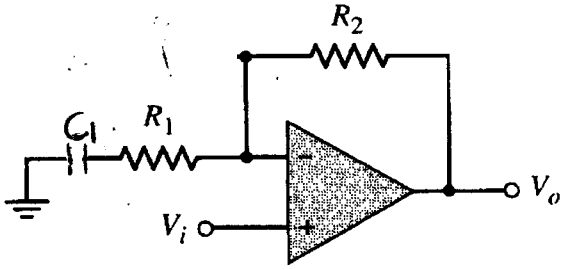
$$R_o = R_L \,//\, R_{22} \,//\, \left[r_{e3} + \frac{R_c}{\beta+1} \right]$$

$$R_{of} = \frac{R_o}{1 + A\beta_f} \Longrightarrow R_{out} = \frac{1}{\frac{1}{R_{of}} - \frac{1}{R_L}}$$

Question # 2:

a) (2)

Derive the transfer function (v_o/v_i) for the active filter shown below, ~~identify the filter type and determine the cutoff frequency ω_o, assume ideal opamp~~



$$\frac{V_o - V_1}{R_2} = V_i\left(\frac{1}{R_1 + \frac{1}{sC_1}}\right)$$

$$\frac{V_o}{V_i} = \frac{1 + s(C_1R_1 + C_1R_2)}{1 + sC_1R_1}$$

b) (2)

Write done general transfer function T(s) for the following filter types:

1. First order Low pass filter.
2. Second order High pass filter.

① $T_{LP} = \dfrac{a}{s + w_o}$

② $T_{HP} = \dfrac{a s^2}{s^2 + \frac{w_o}{Q}s + w_o^2}$

C) (2)

Calculate the cutoff frequency ω_o, center frequency gain, and the bandwidth ω_o/Q for the second order band pass filter with following transfer function T(s).

$$T(s) = \frac{500s}{s^2 + 100s + 10000}$$

$w_o^2 = 10000 \Rightarrow w_o = 100$ rad/sec

$\frac{w_o}{Q} = 100$ rad/sec

Gain = 5