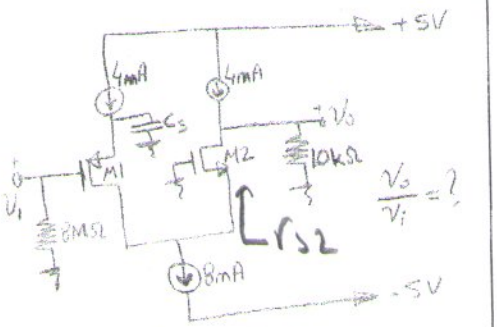
Ele.II summer15 Final Name: GÖZÜM SurName:	Number:
	İmza:

P1 Find the ac gain of the circuit (vo/vi).(5P)



Answer-1
vo/vi = −40

$I_{D1} = I_{D2} = 4mA$

$g_{m1} = \sqrt{2\beta_1 I_{D1}} = 4mS$

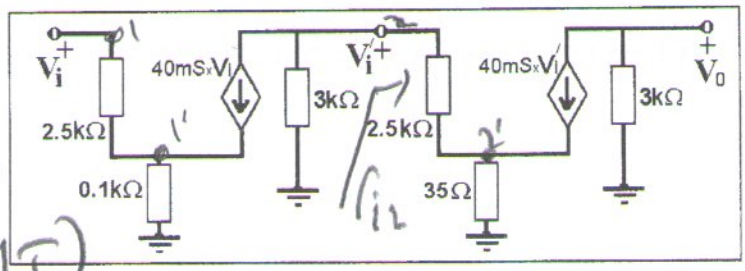
$g_{m2} = \sqrt{2\beta_2 I_{D2}} = 4mS$

$$\frac{V_o}{V_i} = \frac{V_{d2}}{V_{s2}} \cdot \frac{V_{d1}}{V_{g1}}$$

$$= (g_{m2} \cdot 10k) \cdot (-g_{m1} \cdot r_{s2}) \qquad r_{s2} = \frac{1}{g_{m2}}$$

$$= -40$$

P2 The figure shows ac case of a circuit with ac model of the employed transistor. Find the gain of the circuit (vo/vi).(5P)



! Correction → $40mS.V_i \rightarrow 40mS.V_{11'}$

↘ $40mS.V_i' \rightarrow 40mS.V_{22'}$

$g_{m1} = g_{m2} = 40mS$ (BJT)

$\beta_{f1} = \beta_{f2} = 40mS.2.5k = 100$

Answer-2
vo/vi = 800

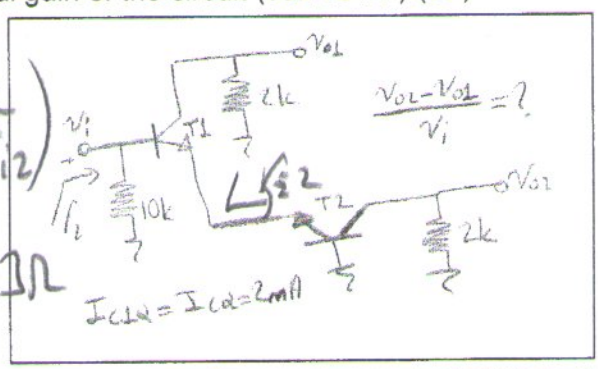
$\frac{V_1'}{V_i} = \frac{-g_{m1}(3k//6k)}{1+g_{m1}(0.1k)} = \frac{-80}{5} \downarrow = -16$

$r_{i2} = \beta_{f2}\left(\frac{1}{g_{m2}} + R_{er}\right) = \downarrow \cong 100(25+35) = 6k$

$\frac{V_o}{V_i'} = \frac{-g_{m2}.3k}{1+g_{m2}(25)} = \frac{-120}{2,4} = -50$

$\frac{V_o}{V_i} = (-16)\times(-50) = 800$

P3 In the figure, ac case of a circuit is given. Find the differential gain of the circuit (vo2-vo1/vi).(5P)



$\frac{V_{o2}}{V_i} = \frac{V_{o2}}{V_{e2}} \cdot \frac{V_{e1}}{V_{b1}} = (g_{m2}2k)\left(\frac{g_{m1}r_{i2}}{1+g_{m1}r_{i2}}\right)$

$g_{m1} = g_{m2} = \frac{2mA}{26mV} = \frac{1}{13}$ $r_{i2} = \frac{1}{g_{m2}} = 13\Omega$

Answer-3
Vo2-vo1/vi = 154

$\frac{V_{o2}}{V_i} = \frac{2k}{13} \cdot \frac{1}{2} \cong 77$

$\frac{V_{o1}}{V_i} = -\frac{g_{m1}.2k}{1+g_{m1}r_{i2}} = -\frac{\frac{1}{13}2k}{2} \cong -77$

$\frac{V_{o2}-V_{o1}}{V_i} = 2\times 77 \cong 154$