Problem (3) [10 points]

For the feedback amplifier given in Fig. 3. A_g=100mA/V, R_i=10KΩ, R_o=10KΩ, β_z=0.1kΩ.

(a) Identify the type of the feedback
(b) Derive the expression for the closed loop gain $A_{gf}=I_o/V_s$, and determine its value.
(c) Derive the expression for the closed loop input resistance R_{if}, and determine its value.
(d) Derive the expression for the closed loop output resistance R_{of}, and determine its value.
(e) Comment on the effect of the feedback on the input and output resistances (increased or decreased)

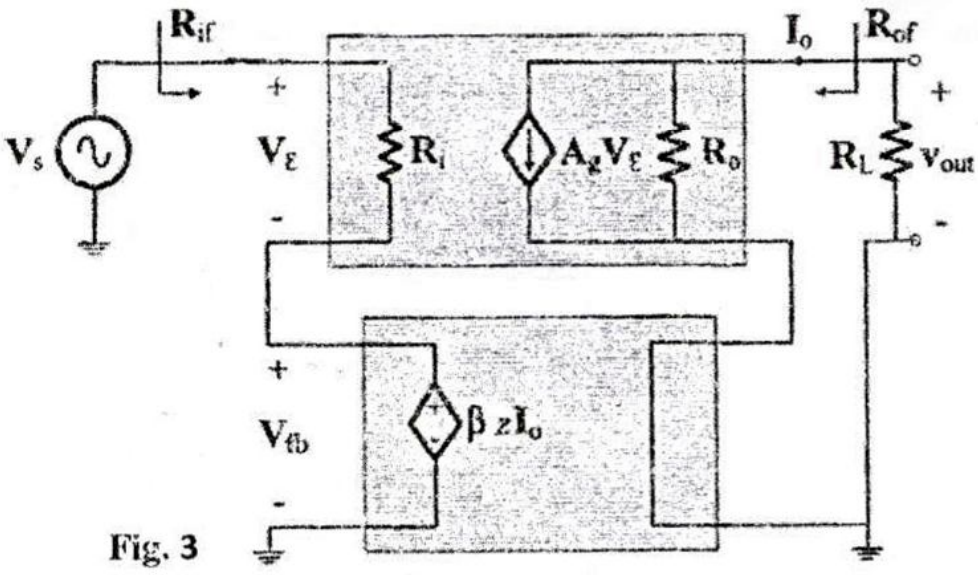

Fig. 3

Problem (4) [15 points]

For the following circuit in Fig. 4, the transistor parameters are: I_{CQ1}=486μA and I_{CQ2}=1.35mA, g_{m1}= 19.64mA/V, g_{m2} =34.92mA/V, $r_{\pi 1}$ =5092Ω, $r_{\pi 2}$ =2857Ω, r_{o2} =r_{o2} = ∞.

(a) Identify the topology of the feedback (mixing/sampling).
(b) Identify the feedback circuit, then find values for R_{11}, R_{22}, and the feedback parameter β_{FB}.
(c) Drew the amplifier without the FB including the effect of R_{11} and R_{22}. Then, find the amplifier Transresistance gain $R_m = \frac{v_o}{i_s}$.
[Hint: use source transformation to get i_s from v_s]
(d) Find the closed-loop gain R_{mf}, then use current voltage relations to find the voltage gain $A_{vf} = \frac{V_o}{V_s}$.
(e) Find the input resistance R_{in} and the output resistance R_o (as indicated in the opposite figure).

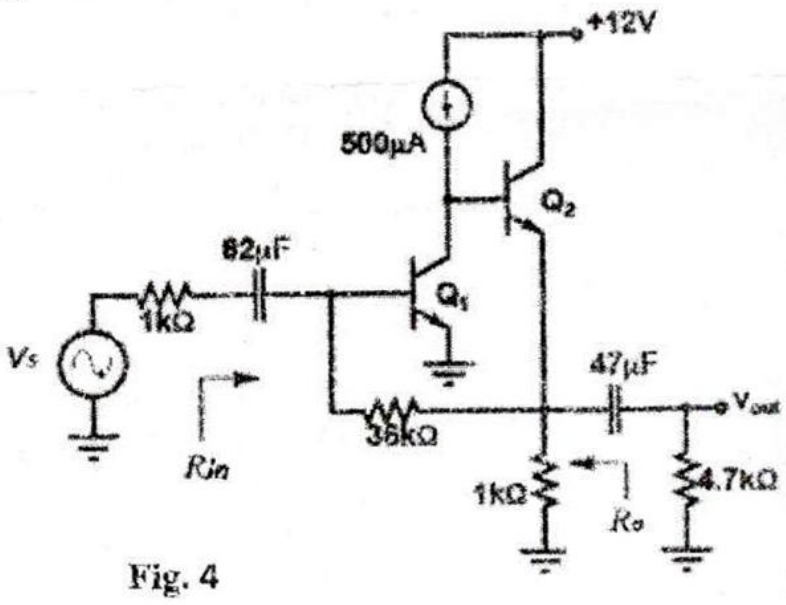

Fig. 4

Problem (5) [15 points]:

For the emitter follower output stage shown below, V_{cc}= -V_{EE}=2.5V, $V_{CE,sat}$=0.2V, $V_{BE,on}$=0.7V, R_L=10kΩ.

(a) Classify this power amplifier.
(b) Find the value of R_1 that results in maximum efficiency.
(c) Draw the transfer function (v_{OUT} versus v_{IN}).
(d) Determine the resulting output voltage swing and the maximum and minimum Q_1 emitter currents, i_{E1}.
(e) Calculate the Average power delivered by the batteries, and the power delivered to the load.
(f) Calculate maximum power conversion efficiency.

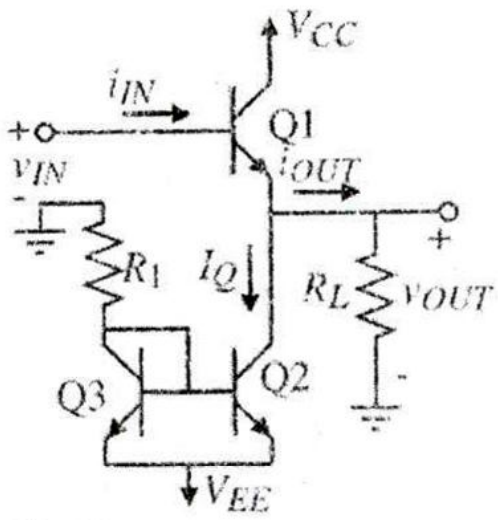

Fig. 5