Assignment

#1 For the circuit shown in Figure 10.37(a), the transistor parameters are VAN =100Vand VAP =60V. Let ICo =0.25mA. (a) Determine the open-circuit small-signal voltage gain. (b) Find the value of RL such that the voltage gain is 60 percent of the open-circuit value. (Ans. (a) Av =−1442, (b) RL =225k————————————)

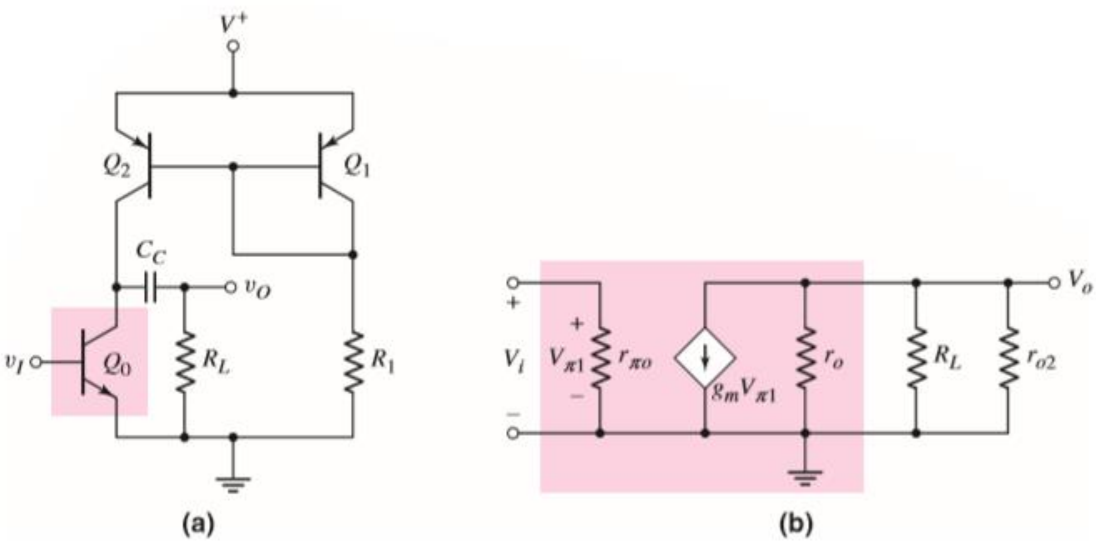

Figure 10.37 (a) Simple BJT amplifier with active load and load resistance and (b) small-signal equivalent circuit

#2 Calculate the small-signal voltage gain of an amplifier with an active load and a load resistance RL. For the circuit in Figure 10.37(a), the transistor parameters are VAN =120Vand VAP =80V. Let VT =0.026V and ICo =0.2mA. Determine the small-signal voltage gain for load resistances of RL = ∞ , 200 k————————————, and 20 k————————————.

#3

Calculate the voltage gain of the circuit of Fig. 18.11.

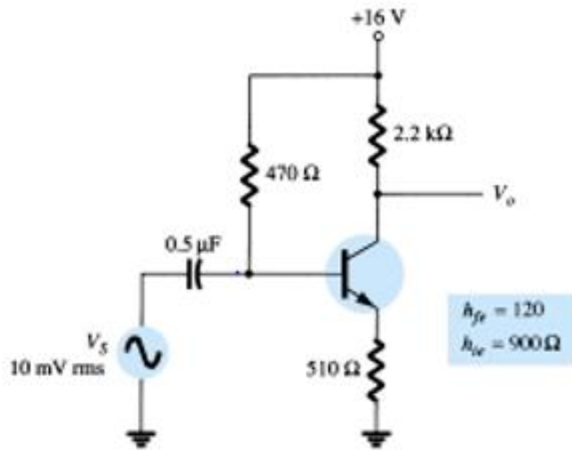

Figure 18.11 BJT amplifier with current-series feedback for

#4

It is desired to design a phase-shift oscillator (as in Fig. 18.21a) using an FET having $g_m = 5000\ \mu S$, $r_d = 40\ k\Omega$, and feedback circuit value of $R = 10\ k\Omega$. Select the value of C for oscillator operation at 1 kHz and R_D for $A > 29$ to ensure oscillator action.

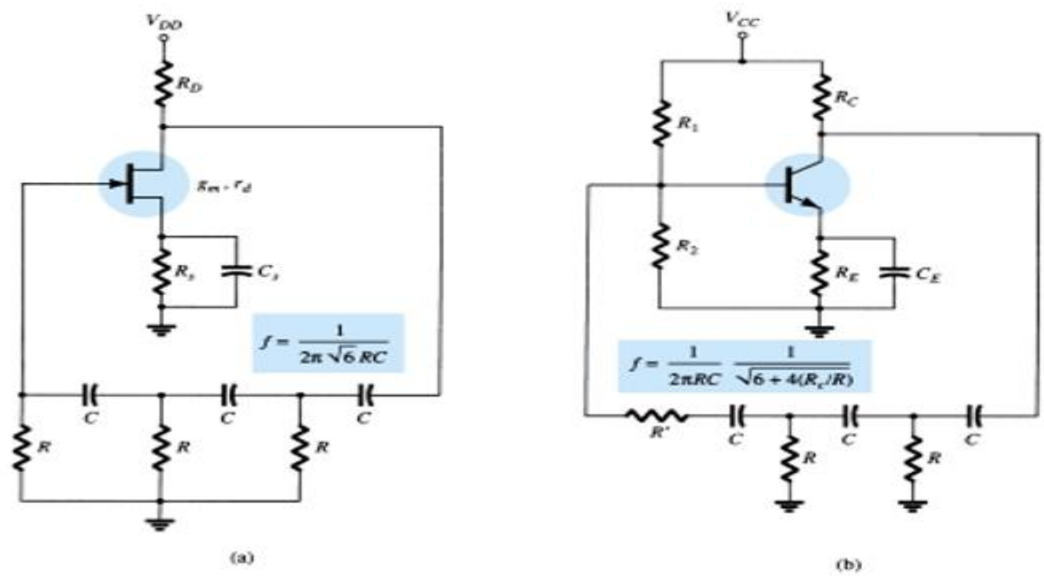

Figure 18.21 Practical phase-shift oscillator circuits: (a) FET version; (b) BJT version.

#5 Design a unijunction oscillator circuit for operation at (a) 1 kHz and (b) 150 kHz

#6

Calculate the gain of a negative-feedback amplifier having $A = -2000$ and $\beta = -1/10$.

If the gain of an amplifier changes from a value of -1000 by 10%, calculate the gain change if the amplifier is used in a feedback circuit having $\beta = -1/20$.

Calculate the gain, input, and output impedances of a voltage-series feedback amplifier having $A = -300$, $R_i = 1.5\ \text{k}\Omega$, $R_o = 50\ \text{k}\Omega$, and $\beta = -1/15$.

#7

(a) The open-loop gain of an amplifier is $A = 5 \times 10^4$ and the closed-loop gain is $A_f = 50$. (i) What is the feedback transfer function? (ii) What is the ratio of A_f to $1/\beta$? (b) Repeat part (a) for $A = 100$ and $A_f = 20$. (Ans. (a) (i) 0.01998, (ii) 0.9990; (b) (i) 0.04, (ii) 0.80)

#8

(a) Consider a general feedback system with parameters $A = 5 \times 10^5$ and $A_f = 50$. If the magnitude of A decreases by 15 percent, what is the new value of A_f and what is the corresponding percent change in A_f? (b) Repeat part (a) if $A = 100$ and $A_f = 20$. (Ans. (a) $A_f = 49.99912$, $-1.76 \times 10^{-3}\,\%$; (b) $A_f = 19.318$, -3.41%)

#9 Determine the bandwidth of a feedback amplifier.

Consider a feedback amplifier with an open-loop low-frequency gain of $A_o = 10^4$, an open-loop bandwidth of $\omega_H = (2\pi)(100)$ rad/s, and a closed-loop low-frequency gain of $A_f(0) = 50$.

10

(a) A feedback amplifier has an open-loop low-frequency gain of $A_O = 5 \times 10^4$, an open-loop bandwidth of $\omega_H = (2\pi)(5)$ rad/s, and a closed-loop low-frequency gain of $A_f(0) = 80$. Determine (i) β and (ii) the closed-loop bandwidth. (b) Using the results of part (a), if β is reduced by 50 percent, determine the percent change in (i) $A_f(0)$ and (ii) ω_{fH}? (Ans. (a) (i) $\beta = 0.01248$, (ii) $\omega_{fH} = (2\pi)(3.125 \times 10^3)$ rad/s; (b) (i) $+100\%$, (ii) -50%)