Nanyang Technological University
School of Electrical & Electronic Engineering
EE2002 Analog Electronics

Tutorial 10

1. In the AC model of the common-base circuit shown in Figure 1, the transistor Q_1 has $\beta = 100$, $V_A = \infty$, $C_\mu = 1$pF and $C_\pi = 10$pF. AC coupling capacitors $C_{c1} = C_{c2} = 1$uF. Assume $V_T = 25$ mV and DC collector current $I_C = 0.5$ mA. Using the OCTC and SCTC methods, determine the upper and lower 3-dB frequency of the amplifier, ω_H and ω_L respectively, and hence the amplifier bandwidth.

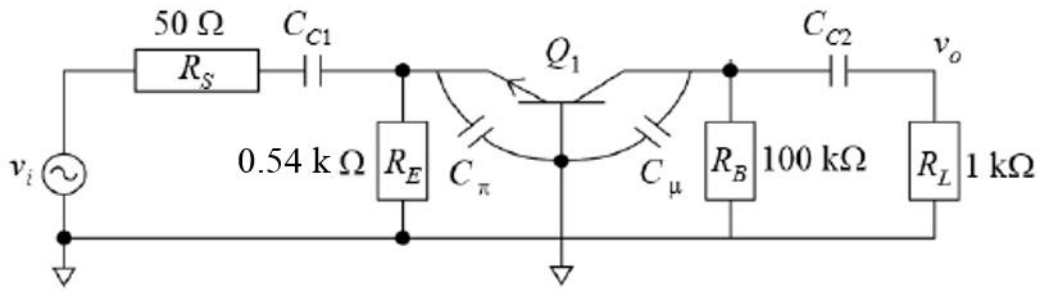

Figure 1

(Ans: ω_H=813 Mrad/s; ω_L=10.5 krad/s; BW=$\omega_H-\omega_L$ =813 Mrad/s)

2. Using the short-circuit time constant method, determine the lower -3dB frequency (ω_L) for the amplifier circuit shown in Figure 2. M2 is a PMOS while M1 is a NMOS. A signal source v_s with a series resistance R_S =1 MΩ is connected to the input at G through a coupling capacitor C_1 = 1μF, while a load resistor R_L = 10 kΩ is connected to the output at D through a coupling capacitor C_2 = 1μF. The resistance R_1 = 5 MΩ. For the transistors M_1 and M_2, $\mu_n C_{ox1}(W_1/L_1) = \mu_p C_{ox2}(W_2/L_2) = 50\ \mu A/V^2$, $|V_{TP}| = V_{TN} = 2V$, and $\lambda = 0.005\ V^{-1}$.

Ans: 34.9 rad/s

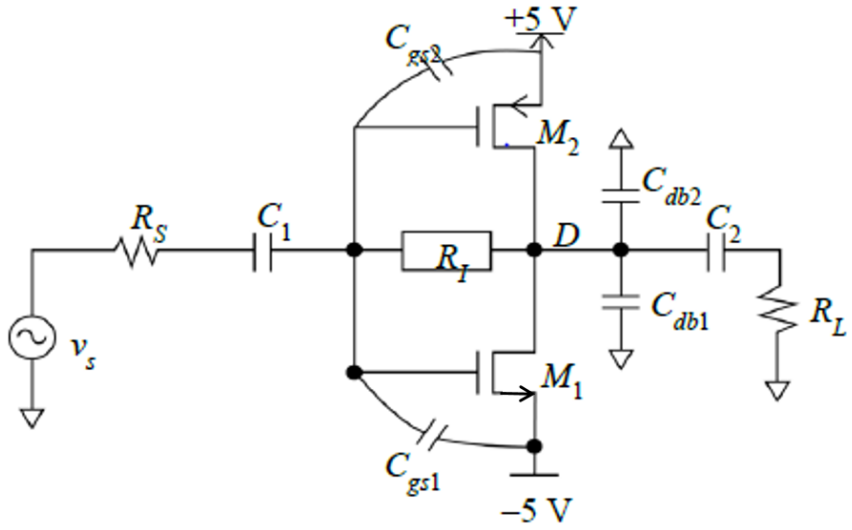

Figure 2