

NANYANG TECHNOLOGICAL UNIVERSITY
SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING
EE4341 ADVANCED ANALOG CIRCUITS
TUTORIAL 5

1. A common-emitter amplifier is given in Fig. 1 (biasing circuitry not shown). To achieve a mid-band voltage gain (v_o/v_s) of 55, what should be the collector biasing current? Plot the magnitude of (v_o/v_s) versus frequency and indicate clearly all the break frequencies. What is the estimated bandwidth of the amplifier? Parameters of

Q_1 : $\beta = 60$, $C_{cb'} = 2$ pF, $C_{b'e} = 10$ pF and $r_{bb'} = 60 \Omega$, $V_T = 25$ mV.

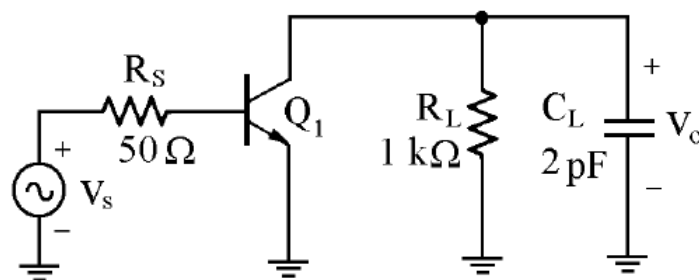


Figure 1

(Answer: $I_C = 1.53$ mA, $f_1 = 12$ MHz, $f_2 = 40$ MHz, BW = 12 MHz)

2. Configure the amplifier circuit in Fig.1 as a CE-CB cascode amplifier. With the same biasing current, plot the magnitude of voltage gain (v_o/v_s) versus frequency. Indicate clearly the relevant break frequencies. What is the estimated bandwidth of the new amplifier circuit? Assume the additional transistor used has the same device parameters as Q_1 .

(Answer: $f_1 = 115$ MHz, $f_2 = 700$ MHz, $f_3 = 40$ MHz, BW = 40 MHz)

3. A multi-stage video amplifier is to amplify an input signal of $100 \mu\text{V rms}$ to an output voltage level of 2 V rms with a 3-dB bandwidth of 30 MHz. The wideband op amps that have a GBW (gain-bandwidth) product of 600 MHz will be used. Determine the number of cascaded op amps that is needed and the voltage gain required for each op amp.

(Answer: 5 stages are needed with 4 stages of identical gain = 7.7 and the last stage gain = 5.7.)