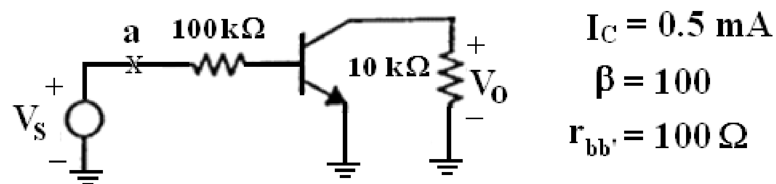
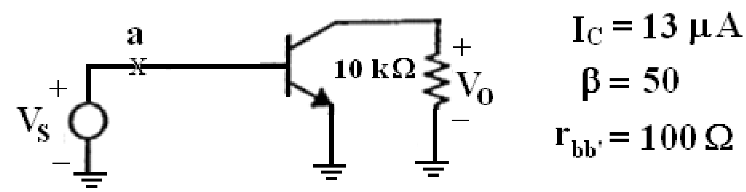
NANYANG TECHNOLOGICAL UNIVERSITY
SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING
EE4341 ADVANCED ANALOG CIRCUITS
TUTORIAL 3

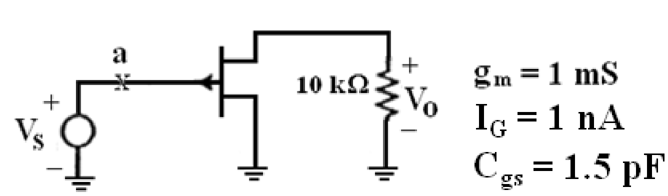
1. Three possible implementations of high-input impedance amplifier (biasing circuit not shown) with input impedance > 100 kΩ are shown in Fig. 1. Neglecting flicker noise and capacitive effect, determine the equivalent input noise voltage and noise current sources of these three circuits looking into point "a" from the signal source V_S. If the equivalent noise bandwidth is 20 kHz for all the three circuits, calculate the total equivalent input rms noise voltage in each case. Comment on these circuits for use as low-noise amplifier for signal source with very low source resistance. Boltzmann's constant k = 1.38 $\times 10^{-23}$ J/K, q =1.6×10^{-19} C and T = 300K. **(Answer: (i) V_i = 19 μV, (ii) V_i = 0.7 μV, (iii) V_i = 0.5 μV)**



(i)



(ii)



(iii)

Fig. 1

2. In Fig. 2, v_g represents an inductive signal source with $v_g = 1$ mV and $L_g = 1$mH. The equivalent input noise voltage and current spectral densities are $\overline{v_n^2} = 2 \times 10^{-19}$ V^2 /Hz and $\overline{\iota_n^2} = 3 \times 10^{-24} A^2$/Hz, respectively. Derive the expression of the total equivalent noise voltage spectral density (in V^2/Hz) seen by the source v_g. Calculate the effective rms noise voltage seen by the source between 0 Hz and 100 kHz. What is the SNR in dB? **(Answer: Vni = 0.244 µV, SNR= 72.3 dB)**

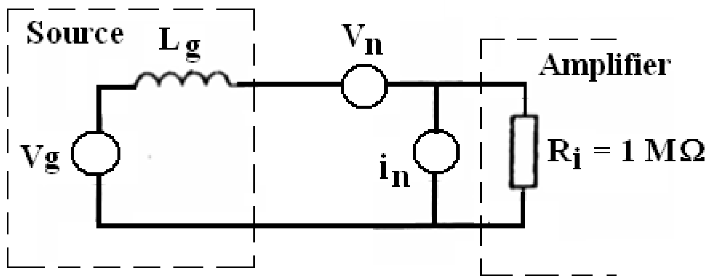


Fig. 2