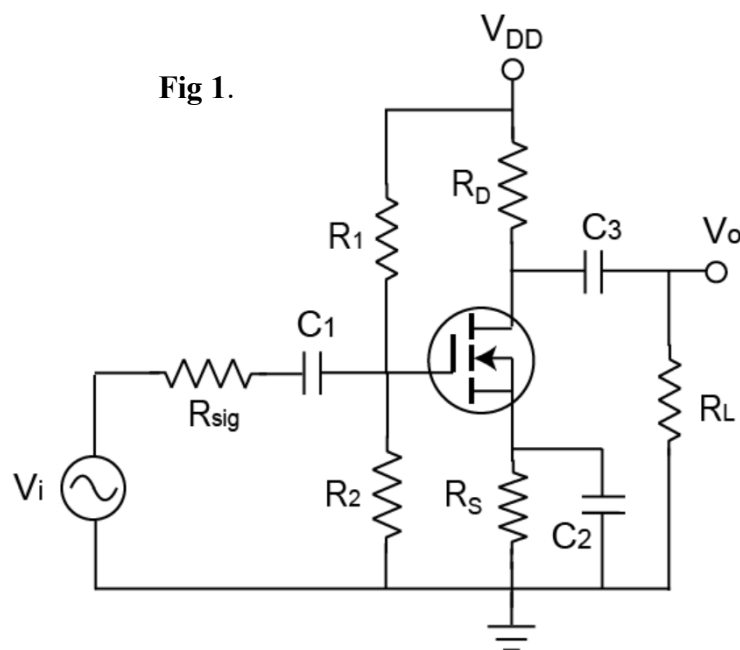
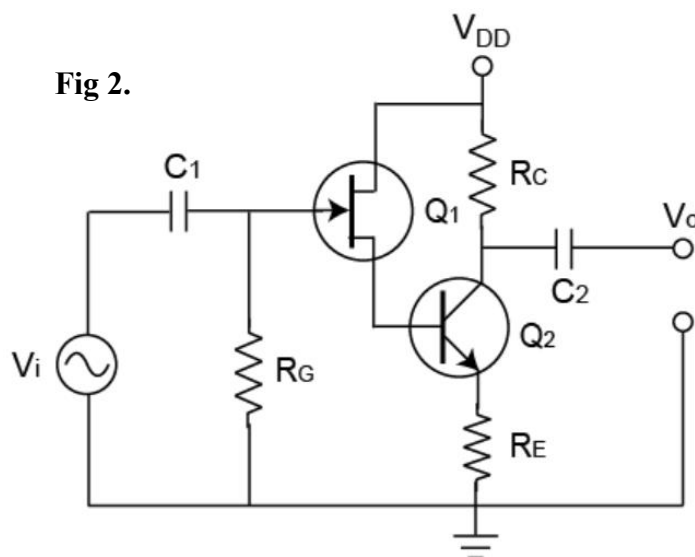


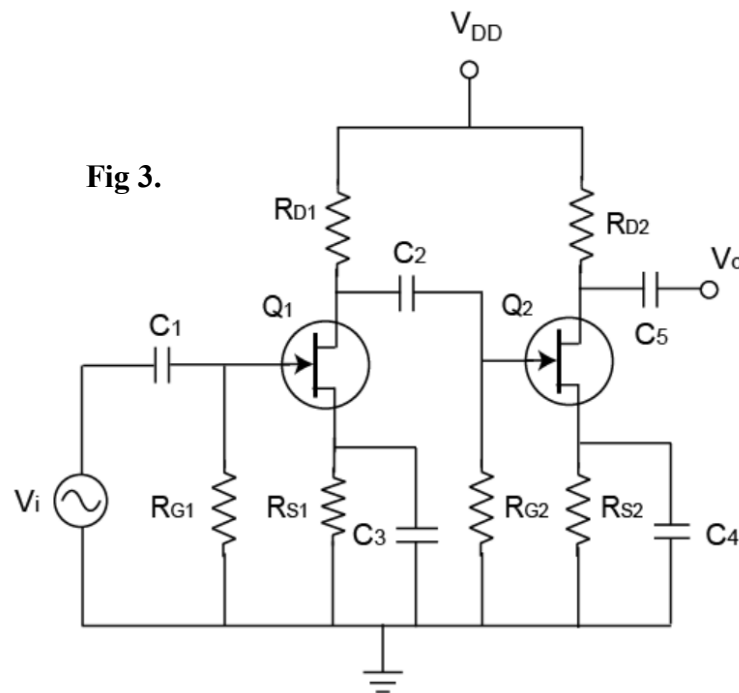
1. Consider the circuit shown in Fig. 1 with E-MOSFET voltage-divider configuration. Here $V_{DD} = 30\text{ V}$, $V_{in} = 0.7\text{ mV}$, $r_d = 40\text{ k}\Omega$, $V_{GS(th)} = 3.2\text{ V}$, $k = 5 \times 10^{-4}$, $R_I = 45\text{ M}\Omega$, $R_2 = 15\text{ M}\Omega$, $R_D = 3.6\text{ k}\Omega$, $R_S = 1.2\text{ k}\Omega$, $R_{sig} = 0.5\text{ k}\Omega$, $R_L = 10\text{ M}\Omega$, $C_1 = C_3 = 0.1\text{ }\mu\text{F}$, and $C_2 = 40\text{ }\mu\text{F}$. Determine (a) I_D and V_{GS} (at Q point) (DC) (b) g_m , (c) $A_V = V_o/V_i$, (d) output impedance Z_o . (20 pt)



2. The two-transistor amplifier shown in Figure 2 combines a FET Q_1 and a BJT Q_2 to achieve both a high input impedance and a large voltage gain. Assume $V_{DD} = 12\text{ V}$, $g_{os} = 50\text{ }\mu\text{S}$ and $V_p = -3\text{ V}$ for Q_1 , and $\beta = 200$ and $r_\pi = 100\text{ }\Omega$ for Q_2 . Here, $R_G = 10\text{ M}\Omega$, $R_C = 3\text{ k}\Omega$, $R_E = 20\text{ }\Omega$, $C_1 = C_3 = 10\text{ }\mu\text{F}$. Determine (a) V_{GS} , I_{DSS} (DC) (b) g_m , Z_i (c) Draw the ac equivalent network, i.e. small signal model, (d) $A_V = V_o/V_i$. (30 pt)



3. Consider the JFET cascade amplifier shown in Figure 3. Assume FET Q_1 and Q_2 are identical with $I_{DSS} = 9 \text{ mA}$, $g_{os} = 50 \text{ } \mu\text{S}$ and $V_p = -2.5 \text{ V}$. Here $V_{DD} = 20 \text{ V}$, $R_{G1} = R_{G2} = 10 \text{ M}\Omega$, $R_{D1} = R_{D2} = 3.3 \text{ k}\Omega$, $R_{S1} = R_{S2} = 470 \text{ }\Omega$, $C_1 = C_2 = C_5 = 0.05 \text{ }\mu\text{F}$, and $C_3 = C_4 = 50 \text{ }\mu\text{F}$. Determine (a) I_{D1} , V_{GS} (DC) (b) g_{m1} , (c) Z_i , and Z_o , (d) $A_V = V_o/V_i$. (30 pt)



4. Consider the circuit shown in Fig 3. Using LT-SPICE determines v_o . Set $v_i = 0.1 \sin(\omega t)$, with for frequency from 1mHz to 100 MHz. Send your LT-SPICE file to NTHU-E-Learner system before the deadline 6/21/2021 pm 23:00). (20 pt)

Note:

- (1) JFET : U406 (or pickup one available in the library with similar characteristics)
- (2) Use your student ID as the file name e.g. 101123456.asc
- (2) Use the "TEXT" function (Edit → text) to write down your answers and attach them on the worksheet.