1) You are given the two port model of an amplifier shown below in Fig. 1. Given that $R_{\text{in}}=100 \, \Omega$, $R_{\text{out}}=10\, k\Omega$ and $R_L = 10\, k\Omega$,
   a. Find the overall voltage gain.
   b. Find the overall transconductance.
   c. Find the overall current gain.
   d. Find the overall transresistance.

2) You are given an NMOS common-gate amplifier with the following data:
   $W/L=10/5$
   $V_{Tn} = 0.7V$
   $\mu_nC_{\text{ox}}=75\mu\text{A/V}^2$.
   $\lambda_n=0.02\text{V}^{-1}$.
   $r_o=r_{oc}$
   a. Find the value for $I_{\text{BIAS}}$ so that $V_{\text{OUT}}=0V$ when $I_{\text{SUP}}=100\mu\text{A}$
   b. Calculate the two-port parameters $R_{\text{in}}$ and $R_{\text{out}}$.
   c. Calculate the overall current gain.
3) You are given an NMOS common-drain amplifier with a current source supply as shown in Figure 3. The input signal source is a voltage. The device data is the following:

- $W/L=20/2$
- $V_{Th} = 0.7V$
- $\mu_n C_{ox}=50\mu A/V^2$
- $\lambda_p=0.05V^{-1}$
- $r_o=r_o$

a. Find the value for $V_{BIAS}$ so that $V_{OUT}=0V$ when $I_{SUP}=200\mu A$

b. Calculate the two-port parameters $R_{in}$ and $R_{out}$.

c. Calculate the overall voltage gain.

Figure 3.