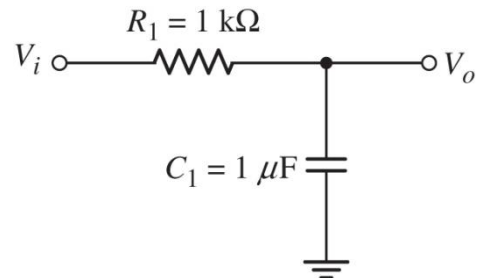


## LO-2

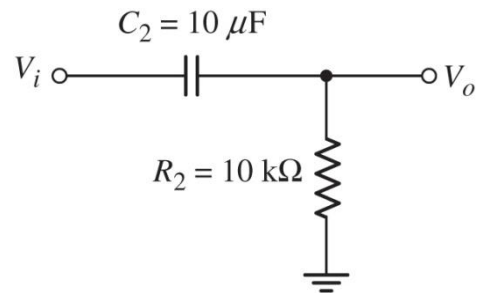
### Low Frequency Response of Transistor Amplifiers

#### System Transfer Function

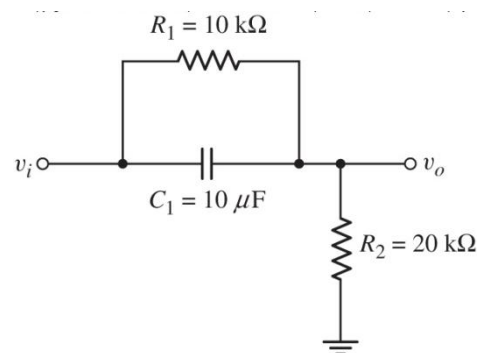
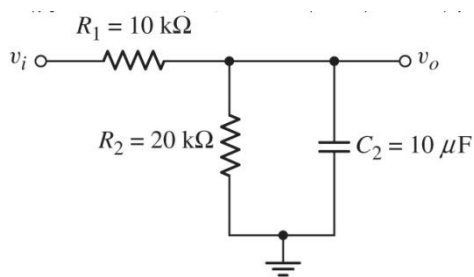
1. Consider the RC-circuit given.
  - (a) Determine the voltage frequency transfer function  $H(j\omega) = V_o(j\omega)/V_i(j\omega)$ .
  - (b) Sketch the Bode magnitude plot and determine the corner frequency.



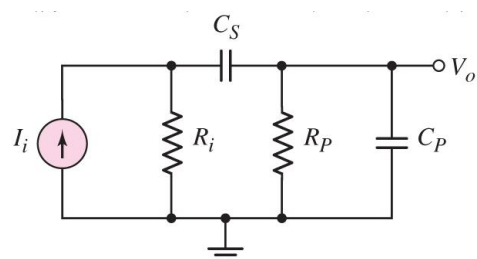
2. Consider the RC-circuit given below.
  - (a) Determine the voltage frequency transfer function  $H(j\omega) = V_o(j\omega)/V_i(j\omega)$ .
  - (b) Sketch the Bode magnitude plot and determine the corner frequency.



3. Consider the RC-circuits given below. For each circuit,
  - (a) Determine the voltage frequency transfer function  $H(j\omega) = V_o(j\omega)/V_i(j\omega)$ .
  - (b) Sketch the Bode magnitude plot and Bode phase plot of the voltage transfer function.
  - (c) Verify your results with a SPICE simulation.

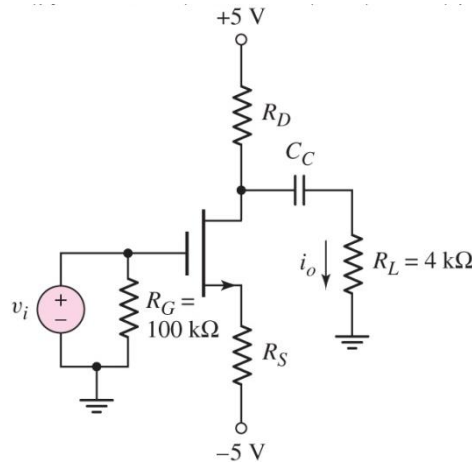


4. Consider the circuit given with a signal current source. The circuit parameters are  $R_i = 30 \text{ k}\Omega$ ,  $R_P = 10 \text{ k}\Omega$ ,  $C_S = 10 \text{ μF}$ ,  $C_P = 50 \text{ pF}$ .
  - (a) Determine the corner frequencies and the magnitude of voltage frequency transfer function  $H(j\omega) = V_o(j\omega)/V_i(j\omega)$ .
  - (b) Sketch the Bode magnitude plot.



## Low Frequency Response

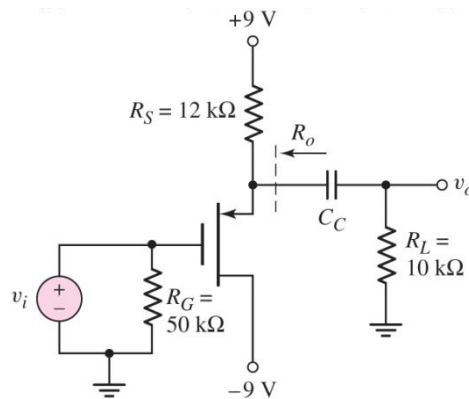
5. For the common source amplifier given below,
- Determine  $R_D$  and  $R_S$  such that  $I_{DQ} = 1 \text{ mA}$  and  $V_{DSQ} = 3 \text{ V}$ .
  - Determine the trans-admittance transfer function  $H(j\omega) = I_o(j\omega)/V_i(j\omega)$ . Determine the expression for the time constant associated with  $C_C$ .
  - Determine  $C_C$  such that the lower corner frequency is 10 Hz.



### The transistor parameters

$$\begin{aligned} V_{TN} &= 1 \text{ V}, \\ K_N &= 0.5 \text{ mA/V}^2, \\ \lambda &= 0. \end{aligned}$$

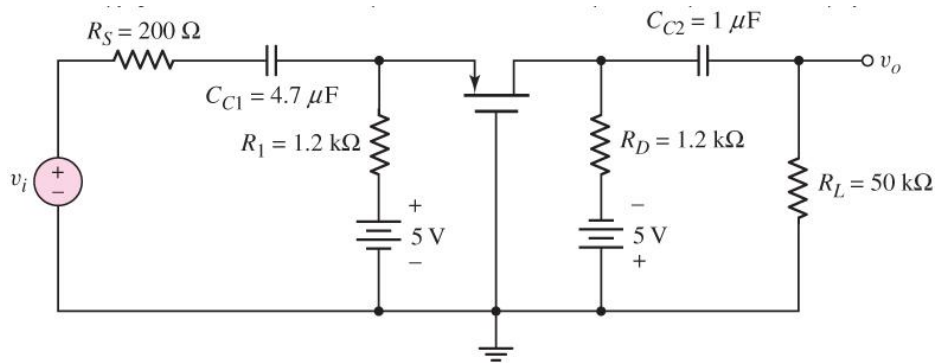
6. For the source follower given below,
- Determine  $R_O$ .
  - What is the expression for the time constant associated with  $C_C$ .
  - Determine  $C_C$  such that the lower 3-dB frequency is 20 Hz.



### The transistor parameters

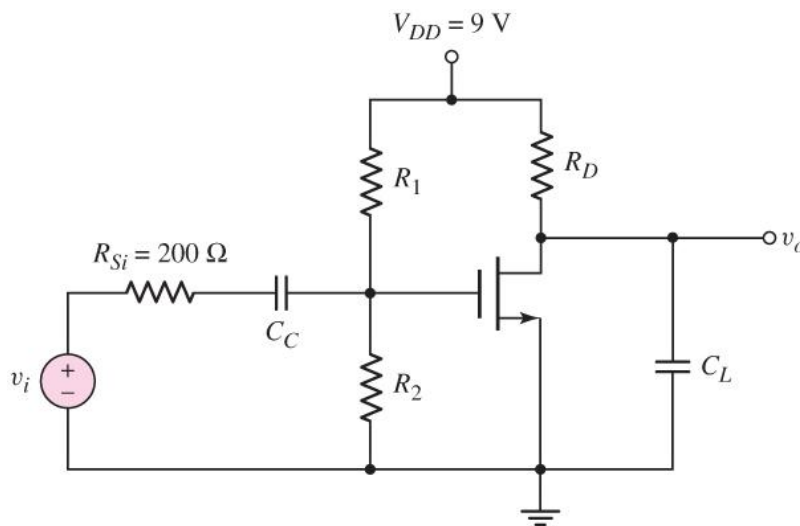
$$\begin{aligned} V_{TN} &= 1 \text{ V}, \\ K_N &= 0.5 \text{ mA/V}^2, \\ \lambda &= 0. \end{aligned}$$

7. For the common gate amplifier given below,
- Determine the quiescent and small signal parameters of the transistor.
  - Sketch the Bode magnitude plot of the voltage frequency transfer function and determine the corner frequency.



The transistor parameters  
 $V_{TP} = -1.5 V$ ,  
 $K_P = 1 \text{ mA/V}^2$ ,  
 $\lambda = 0$ .

8. A MOSFET amplifier with the configuration given below is designed for use in telephone circuit. The magnitude of the voltage gain should be 10 in the midband range, and midband range should extend from 200 kHz to 3 kHz. (Note: A telephone's frequency range does not correspond to a high fidelity music system's) Determine all resistor and capacitor values.



The transistor parameters  
 $V_{TN} = 1 V$   
 $K_N = 0.5 \text{ mA/V}^2$   
 $\lambda = 0$ .

Load  
 $C_L = 1 \text{ pF}$

9. For the common source amplifier given,
- Determine  $R_D$  and  $R_S$  such that  $I_{DQ} = 0.5 \text{ mA}$  and  $V_{DSQ} = 4 V$ .
  - Determine the break frequencies and 3-dB corner frequency.
  - Sketch the Bode magnitude plot of the voltage frequency transfer function.
  - If the resistor  $R_S$  is replaced with a constant-current source producing the same  $I_{DQ}$  quiescent current, determine the 3-dB corner frequency and sketch the Bode magnitude plot.

The transistor parameters  
 $V_{TN} = 0.8 V$ ,  
 $K_N = 0.5 \text{ mA/V}^2$ ,  
 $\lambda = 0$ .

