Laboratory Application Assignment

In this lab application assignment you will examine the ability of a transistor to amplify a small ac signal. You will build a common-emitter amplifier and measure the input and output voltages so you can determine the voltage gain, A_V. You will also see how the emitter bypass capacitor, C_E, and load resistance, R_L, affect the voltage gain, A_V.

Equipment: Obtain the following items from your instructor.

- 2N2222A *npn* transistor or equivalent
- Assortment of carbon-film resistors
- Two 100-μF electrolytic capacitors and one 220-μF electrolytic capacitor
- DMM
- Oscilloscope
- Function generator
- Variable dc power supply

Common-Emitter Amplifier Calculations

Examine the common-emitter amplifier in Fig. 29–26. Calculate and record the following dc quantities:

$V_B =$ _____, $V_E =$ _____, $I_E =$ _____,

$V_C =$ _____, $V_{CE} =$ _____

Next, calculate and record the following ac values with the emitter bypass capacitor, C_E, connected but *without* the load resistor, R_L. Note that $V_{in} = 10\ mV_{p\text{-}p}$.

$r'_e =$ _____, $A_V =$ _____, $V_{out} =$ _____

Connect the load resistor, R_L, and recalculate A_V and V_{out}.

$A_V =$ _____, $V_{out} =$ _____

What happened to A_V and V_{out} when R_L was added?_____

With the load resistor, R_L, still connected, remove the emitter bypass capacitor, C_E, and recalculate A_V and V_{out}.

$A_V =$ _____, $V_{out} =$ _____

What happened to A_V and V_{out} when C_E was removed?_____

_____

Common-Emitter Amplifier Measurements

Construct the common-emitter amplifier in Fig. 29–26. Adjust the input voltage, V_{in}, to exactly 10 $mV_{p\text{-}p}$. Measure and record the following dc quantities:

$V_B =$ _____, $V_E =$ _____, $I_E =$ _____,

$V_C =$ _____, $V_{CE} =$ _____

Next, measure and record the output voltage, V_{out}, with the emitter bypass capacitor, C_E, connected but *without the* load resistor, R_L. Using the measured value of V_{out}, calculate the voltage gain, A_V.

$V_{out} =$ _____, $A_V =$ _____

Connect the load resistor, R_L, and remeasure V_{out}. Using the measured value of V_{out}, recalculate A_V.

$A_V =$ _____, $V_{out} =$ _____

What happened to V_{out} and A_V? _____

With the load resistor, R_L, still connected, remove the emitter bypass capacitor, C_E, and remeasure V_{out}. Using the measured value of V_{out}, recalculate A_V.

$V_{out} =$ _____, $A_V =$ _____

Did A_V and V_{out} decrease substantially? _____ If yes, explain why. _____

_____

_____

_____

Figure 29–26