Laboratory Experiment

Experiment

2

DC AMPLIFIER

Lab. Student: _____ **Rating:** _____

Lab Instructor's Initial: _____ **Date Performed:** _____

Experiment's objectives:

- To demonstrate the how the input resistance of an amplifier is affected by the Beta of the transistor and the value of the emitter resistor.
- To demonstrate how Beta can be increased with Darlington circuit.

Materials Required:

1 unit Analog Multimeter	1 pc 100pF Capacitor
1 unit Dual Trace Oscilloscope	1 pc 1000pF Capacitor
2 pc MPSA20 NPN Transistor	1 pc 1N4001 Si diode
1 pc 100 ohm, ½ Watt resistor	1 pc MPSA13 NPN Darlington
1 pc 10 K ohm, ½ Watt resistor	2 pc 1K ohm, ½ Watt resistor

Note: Please check the box after the material has been identified.

Procedure:

1. While the power switch on your Electronic Design Experimenter is off, construct the RC filter circuit shown in Figure 4-31. Notice that Q4 and R18 are inside the Experimenter and are shown for explanation purposes only. Then wire the filter circuit to the Generator square output on the experimenter. When the wiring is complete and correct, turn on the experimenter. NOTE: As a general rule, it is good to always turn the experimenter off each time you are making a major change in the circuitry.
2. Turn on your oscilloscope and set the controls as follows:
   TRIGGERING – INT/EXT/LINE – INT position
   TRIGGERING – (+/-) – (+)
   TIME/CM – 200 µsec or 0.2msec
3. Connect the ground lead of the oscilloscope to point B in the circuit. Connect the vertical lead of the oscilloscope to point A.
4. Adjust the generator controls on the experimenter as follows:
   RANGE – Set to LOW
   FREQ – Set midway between 200Hz and 1KHz

5. Refer to Figure 4-32 and adjust the oscilloscope's HORIZ POS control so the trace starts on the left. Then adjust the VER POS, VOLTS/DIV and VARIABLE controls so the entire trace covers exactly 5 centimeters vertically. The FREQ control on the experimenter should be adjusted to so point C is place exactly as shown in Figure 4-32.
6. Measure the time required for the trace to fall from point C to point D as shown in Figure 4-32. D is the point at which the waveform falls to 37% of its maximum amplitude.

   Time = _____ µsec
7. Remove the 100K ohm resistor and replace it with a 10 K ohm resistor.
8. Set the oscilloscope's TIMEDIVE switch to 200 µsec/div and adjust the FREQ control on the experimenter so point is placed exactly as shown in Figure 4-32. Switch the RANGE switch to HIGH on the experimenter if necessary to obtain the proper trace. Readjust the VERT POS and vertical VARIABLE control to obtain 5 centimeters of deflection vertically.
9. Measure the time required for the trace to fall from C to point D as shown in Figure 4-32

   Time = _____ µsec
10. Use the formula TC=RXC to compute the time constant of the RC circuit. Determine the time constant for:
    1. A 100K ohm resistor and a 0.001µF capacitor

       TC = _____ microseconds (µsec)
    2. A 10K ohm resistor and a 0.001µF capacitor

       TC = _____ microseconds (µsec)
11. Construct the circuit shown in the Figure 4-32.
12. Adjust the positive power supply voltage to 15 volts.
13. Set your oscilloscope controls as indicated in step 2. View the waveform between point A and ground. Repeat steps 4 and 5.
14. Observe the waveform at points A and B and notice that the two are almost identical except that the waveform at point A is slightly larger than the one at point B. Leave the vertical lead of the oscilloscope at point B. Record the time constant for the waveform at point B, using the method in step 6.

    Time = _____ µsec
15. Now change the value of resistor R1 to 2K ohms, using two 1K ohms resistor in series.
16. Measure the time constant or the waveform at point B. using the method in step 6.

    Time = _____ µsec
17. Construct the circuit shown in Figure 4-34.
18. Adjust the positive power supply voltage to 10 volts.
19. View the waveform between point B and ground.
20. Measure the time constant for the waveform at point B using the method in step 6.

    Time = _____ µsec
21. Construct the circuit shown in Figure 4-35. Make sure you connect the transistor as shown in the Figure. Set the supply voltage to +10 volts.
22. Measure the time constant for the waveform at point B using the method in step 6.

    Time = _____ µsec

    Is this time longer or shorter than the one you had in step 20?

    _____ shorter by _____µsec

    _____ longer by _____µsec

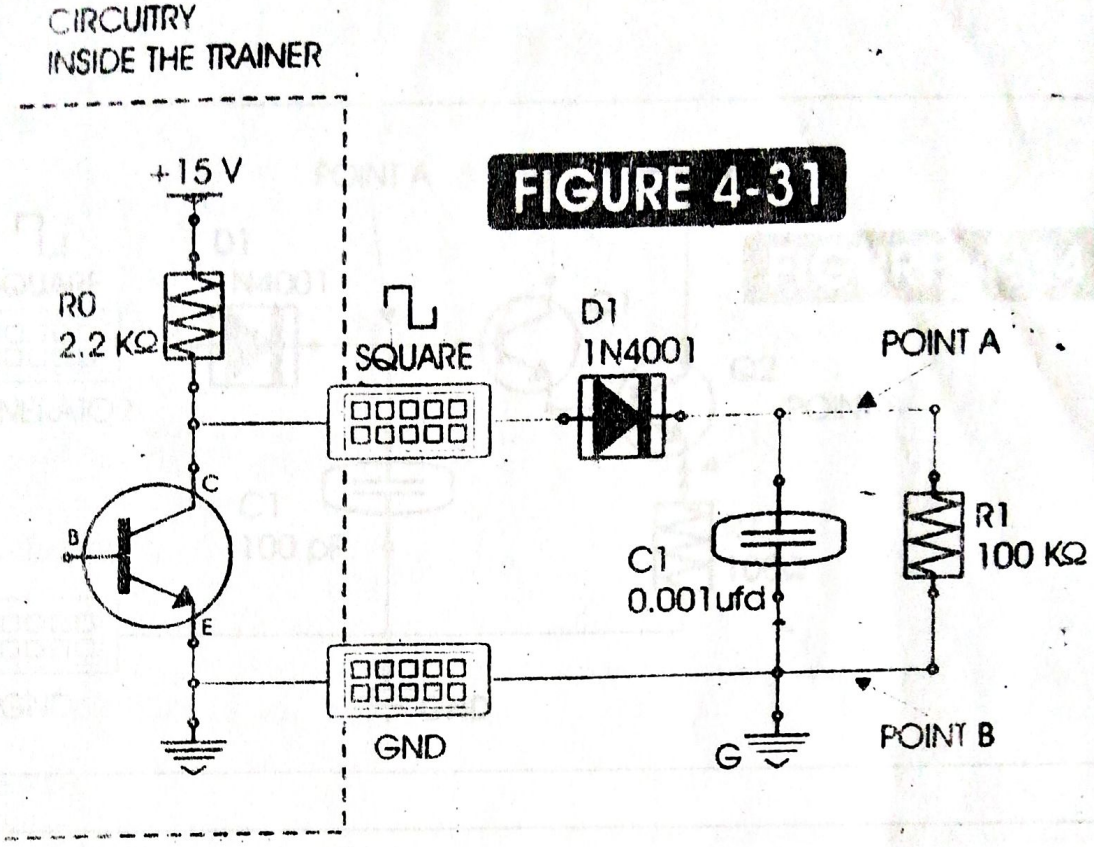

FIGURE 4-31

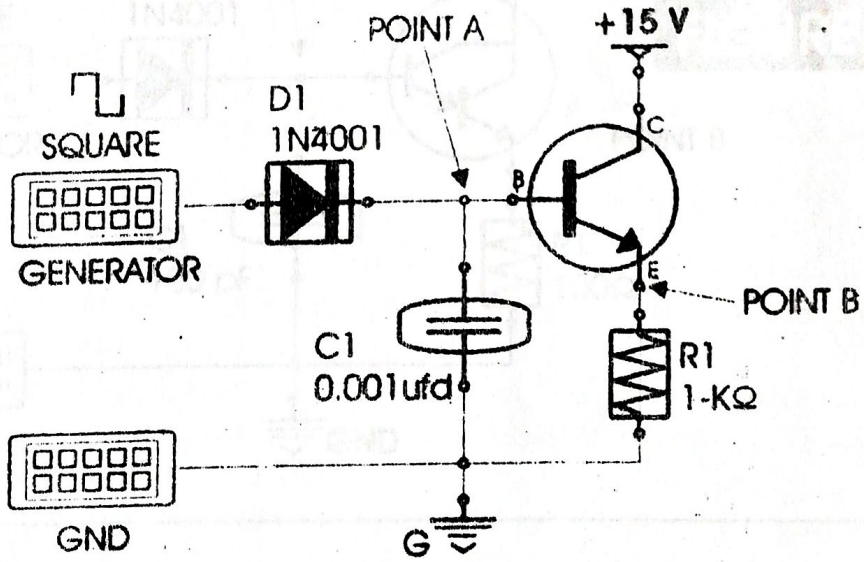

FIGURE 4-32

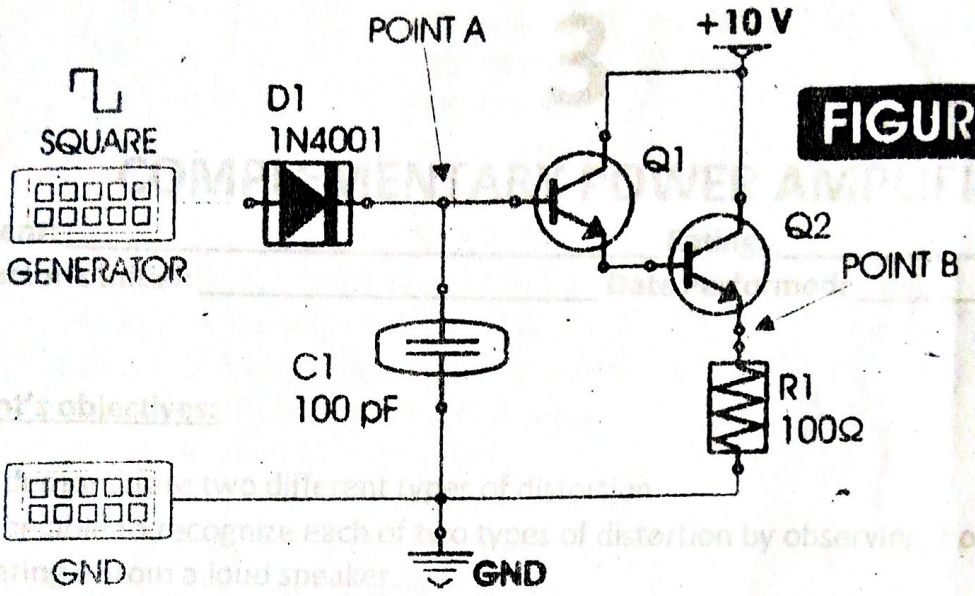

FIGURE 4-34

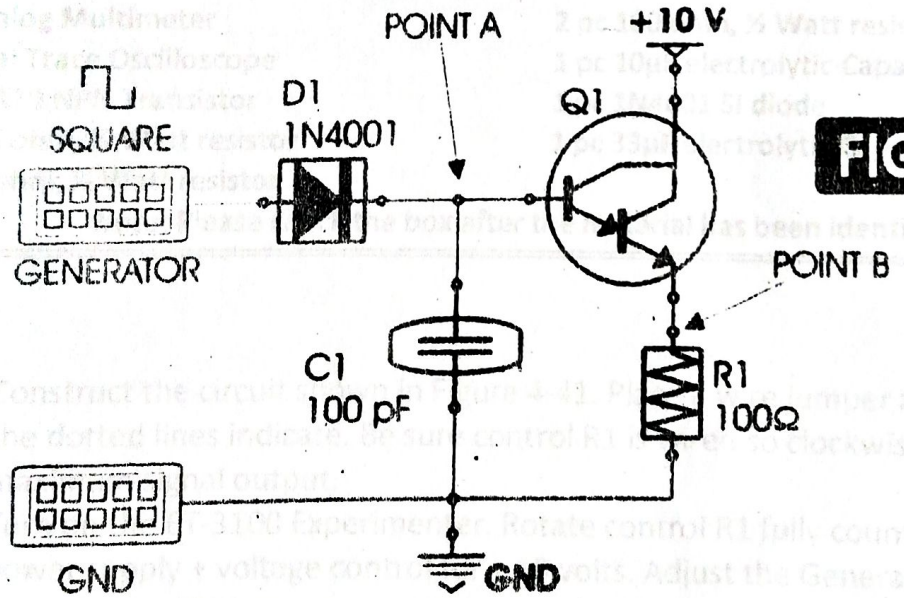

FIGURE 4-35