EXPERIMENT NO. 1
CASCADED TRANSISTOR AMPLIFIER

I. Objective

1. To determine the range of linear operation of an RC-coupled two-stage amplifier.
2. To observe the phase relationships at the input and output of each stage in the amplifier.
3. To troubleshoot an audio amplifier.

II. Equipment & Materials

Power Supply :	Variable regulated low-voltage DC source
Equipment :	Oscilloscope
	Digital Multimeter
	0-25mA DC Milliammeter
	AF Generator
Resistors :	100Ω , 470 Ω, 560 Ω, 1000Ω , 8.2 kΩ, 10 kΩ , 18 kΩ, 33 kΩ - ½ W
Capacitors:	Two 25μF 50V
	Two 100μF 50V
Semiconductors:	2N6004
	2N2102
Miscellaneous :	500Ω - 2W Potentiometer
	Two SPST Switches

III. Schematic Diagram

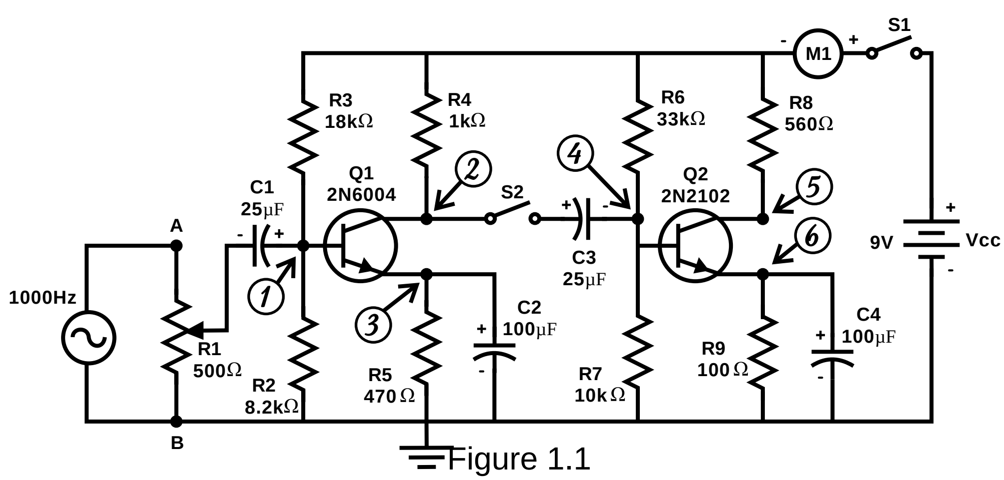

Figure 1.1

IV. Procedure

1. Connect the circuit of figure1.1. An AF Signal Generator set at 1000Hz minimum output is used as the signal source. Power switch S_1 is open, S_2 is closed. R_1 is set to minimum, Point B. M_1 is a milliammeter connected to measure total DC current in the circuit.

Table 1.1 Cascade Amplifier Measurements

	SIGNAL V_{P-P}		DC, V		I_T, mA	
TEST POINT	S_2 CLOSED	S_1 OPEN	S_1 CLOSED	S_2 OPEN	WITH SIGNAL	WITHOUT SIGNAL
2						
3						
4					R_{CB} ,Ω	R_{AB} ,Ω
5						
6						
1						

2. Set the output of the power supply to 9V. Close S_1. Monitor the DC supply and maintain its output at 9V throughout the experiment.

3. Connect an oscilloscope to R_1's wiper (Point C). Set the output of the generator at 50mV. Now connect the oscilloscope at the collector of Q_2. Test Point 5 (TP5). Slowly adjust R_1 just below the point where the sine wave starts distorting, which is the maximum input signal that the circuit can handle without distortion. Leave R_1 set at this level.

   Note: If the circuit is unstable (oscillates), bypass the collector of Q_1, with a 0.1µF capacitor. This stops oscillation but also reduces high frequency response.

4. Measure and record in table 1.1, the peak-to-peak signal voltage at every test point shown in figure 1.1. Measure also, and record in table 1.1 the DC voltage at every test point and the total current I_T as read on M_1.
   Measuring Signal voltage at TP1.

5. Remove R_1 from the circuit. Do not vary the setting of R_1. Measure the resistance from the center arm (Point C) to Point B. Record it in table 1.1. Measure also and record the total resistance of the control, Points A to B. Compute and record the input signal in millivolts delivered at TP1 by substituting the measured values R_{CB} and R_{AB} in the formula

$$V = \frac{R_{CB}}{R_{AB}} \times 50mV$$

   (You will recall that 50mV is the signal applied across the volume control in step 2 to 4.)

6. Record I_T, the total current with no signal applied (R_1 removed). Replace R_1 into the circuit with the same connections as before.

7. Open S_2, disconnecting the output of Stage 1 from the input of Stage 2. Again measure and record the peak-to-peak signal level and DC voltage at every test point.

8. Have an assistant insert a trouble into your circuit. Using signal flow troubleshooting techniques, find the problem by connecting the "trouble" AC and DC measurements with the "good" values measured in step 4.

   What was wrong with the circuit?

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   ____
   ____

V. Questions

1. Does the input circuit of Q_2 have any effect on the signal level at the collector Q_1? Describe the effect, and explain it. Refer to your data.
2. Does the experimental procedure suggest a method for isolating the trouble to Q_1 or Q_2, in a dead amplifier such as that in figure 1.1? Explain the procedure.
3. Explain the level of signal at test points 3 to 6 in the experimental circuit.
4. What is the voltage gain of the total amplifier? Show your computations. How is the total voltage gain related to the individual voltage gain of Q_1?
5. Comment on the total DC current in the circuit, with and without signal.
6. Is there any apparent change in DC voltage level at test points 4, 5 and 6 with S_2 open or closed? Why?
7. List three methods for coupling amplifiers in cascade.

VI. Discussion

VII. Observation

VIII. Conclusion