Experiment #2 Multistage amplifiers

Objective

To measure and calculate the voltage gain of a multistage amplifier

Equipment

Function generator with probes
DMM
Dc supply
oscilloscope with probes
IT-2012 Trainer

Theory

When the amplification of a single transistor amplifier is not enough for some purpose then multistage amplifier come into play. Two or more amplifier can be connected in a Cascade arrangement with output of one amplifier acting as input for next. Each amplifier is a cascaded arrangement is known as a stage. The basic purpose of multistage amplifier arrangement is to increase our all voltage gain Av.
So Av in multistage arrangement is

$$Av_{=}A_{v1} * A_{v2} * A_{v3} \dots A_{vn} \qquad (2.1)$$

When n is number of stages

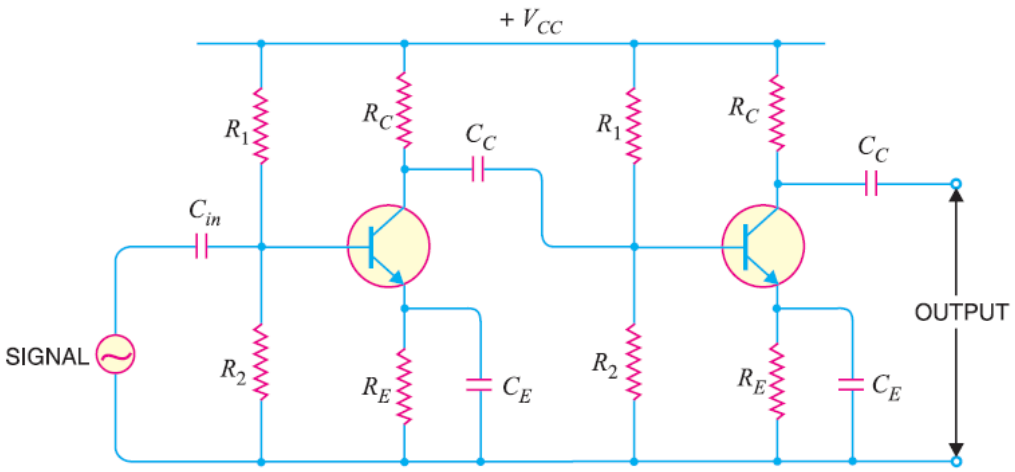

Figure 2.1: Multistage Amplifiers

There are two ways of cascading amplifiers.

1. Direct coupling.
2. Capacitive coupling

1. Direct coupled multistage amplifiers

In this arrangement there are no coupling and bypass capacitors. The collector voltages of a stage provide the base voltage for second stage because of direct coupling these types of multistage amplifier have better low frequency response. The disadvantage is that a small change in DC base voltage due to temperature will result a drift in DC Level throughout circuit.

2. Capacitively Coupled Multistage Amplifier

This arrangement the coupling and bypass capacitors are present. This type of coupling prevent the DC biased of one stage from effecting the other but allows AC signal to pass without attenuation. In determining voltage gain of first stage, one must consider loading effect. This is because of coupling capacitors appears as a short circuit at signal frequency The total input resistance of second stage presents an AC load to first stage.

Circuit Diagram

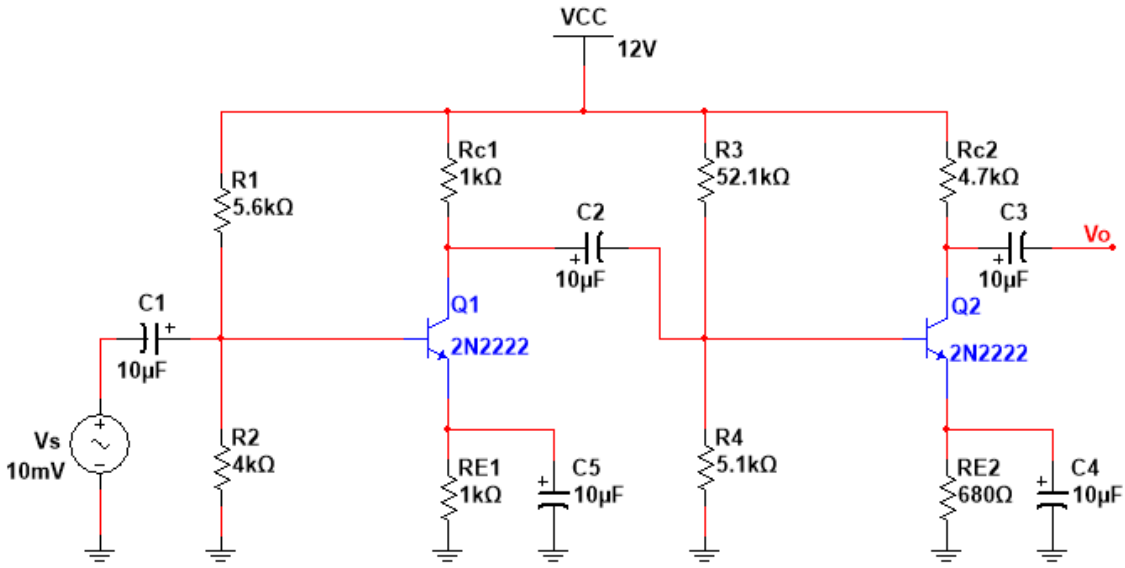

Figure 2.2: Circuit Diagram of Multistage Amplifiers

Procedure

1. Set the IT 2012 trainer on lab table and powered it up.
2. Locate multistage block on trainer.
3. Connect the circuit according to given circuit diagram.
4. Apply +12 voltage Vcc supply to circuit and measure DC parameters such as V_B, V_C , V_E by using DMM.
5. Calculate the current I_C, I_E and I_B.
6. Apply a sine wave of I MHz frequency, 50mv p-p as an input signal at input of circuit using a function generator.
7. By using an oscilloscope, measure the AC voltage.
8. Measure Vo at the output of second amplifier and calculate overall voltage.

9. Calculate the voltage gain of first stage and second stage respectively by using the (2.2) and (2.3) respectively.

$$A_{v1} = \frac{R_{c1}}{r_{e1}} \qquad (2.2)$$

$$A_{v2} = \frac{R_{c2}}{r_{e2}} \qquad (2.3)$$

10. Then we calculated our all voltage gain as

$$A_{vo} = A_{v1} * A_{v2} \qquad (2.4)$$

Observations

Parameters	Theoretical Values	Practical Values	Parameter	Theoretical Values	Practical Values
V_{B1}			A_{v1}		
V_{E1}			A_{v2}		
V_{C1}			A_{vo}		
I_{C1}					
I_{E1}					
I_{B1}					

Lab Task

1. Find the effect of load resistance R_l on the voltage gain A_v and output voltages of circuit diagram.

Conclusion