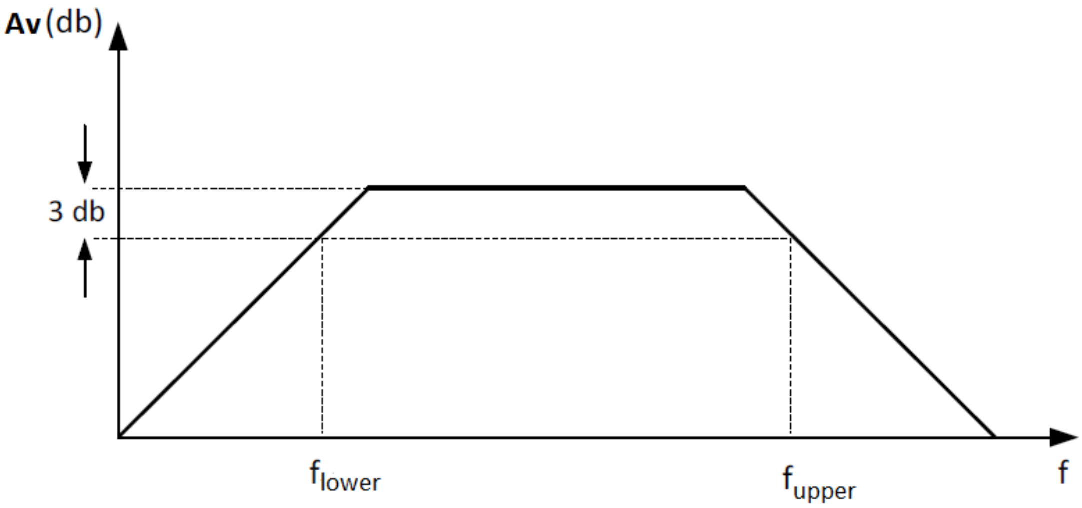
1. INTRODUCTION

The difference between the upper cutoff and lower cutoff frequencies of an amplifier is defined as the bandwidth of the amplifier. So bandwidth will be;

$$B = f_{upper} - f_{lower}$$

Bandwidth beyond sound frequencies amplifiers are called 'wideband amplifiers'. The upper cutoff frequency of such amplifiers can range from a few MHz to GHz and the most important application areas are high frequency communication circuits and video signal circuits.



Nowadays in integrated circuits, using the transistor pairs (differential amplifier and cascode circuit), and applying local feedback are methods of designing a wideband amplifier.
The first way to increase the bandwidth is to reduce the influence of the internal capacitances of the active element by making the circuit design appropriate. In this method differential amplifiers or cascode amplifiers are used.

The next method is to apply local feedback to the amplifier and thus take advantage of the negative feedback properties. In a amplifier with multiple gain stages, the designer can apply feedback to each stage separately, as well as to the whole system. Local feedback is preferred because applying feedback to the entire system can bring inconveniences in terms of circuit stability.

Another method is to compensate the circuit with L-C elements. While doing this method, inductance can be connected to the input of the active element in series or in parallel, and it is called serial compensation or parallel compensation according to the connection type.

2. EXPERIMENT 1: Differential Amplifier

2.1. PART A

Step 1:

Set up the circuit in Figure 1 for RC = RC '= 3.3k Ω and R1 = 22k Ω. Npn transistors are 2N2222.

Make the collector currents of T1 and T1‘ equal with changing RF1 and RF2 values. RF1+RF2 must be 10k Ω. In this case measure the voltages of the circuit by doing DC analysis.

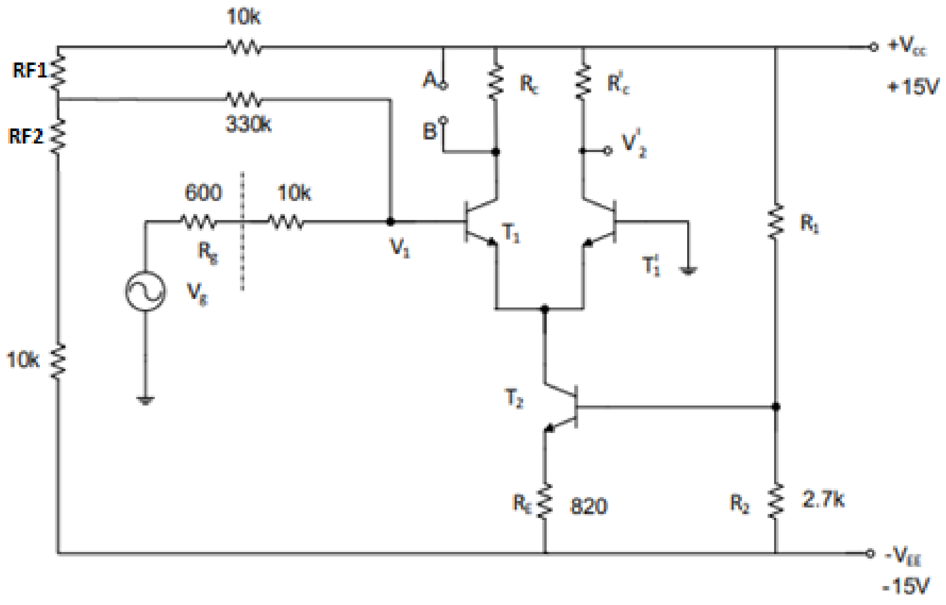


Figure - 1

Fill in the table below.

	V_C	V_B	V_E
T1			
T1’			
T2			

Step 2:

Observe the voltage gain V2’/V1 by making the frequency of Vg signal 5 different values. 1kHz, 10 kHz, 100 kHz, 1 MHz and 10 MHz .

Record your observations in the table below.

	1 kHz	10 kHz	100 kHz	1 MHz	10MHz
V2’					
V1					
Av					

In this case;

Cutoff frequency =

Gain =

Step 3:

Observe the output signal by applying a 50KHz square wave to the input signal Vg. Do you observe slewing?

In this case;

Rising time =

Falling time =

2.2. PART B

Repeat all measurements of 3 steps in Part A by making Rc = 0 (short circuit A-B terminals).

Step 1:

	V_C	V_B	V_E
T1			
T1’			
T2			

Step 2:

	1 kHz	10 kHz	100 kHz	1 MHz	10MHz
V2’					
V1					
Av					

Step 3:

Observe the output signal by applying a 50KHz square wave to the input signal Vg. Do you observe slewing?

In this case;

Rising time =

Falling time =

2.3. Comparison of PART A and PART B

Comparison to part A;

a) How have fall and rise times changed in part B? Why?

b) Has the gain changed? Has the bandwidth changed? How have

cutoff frequencies (lower cutoff / upper cutoff) changed?

3. EXPERIMENT 2: Parallel Compensation

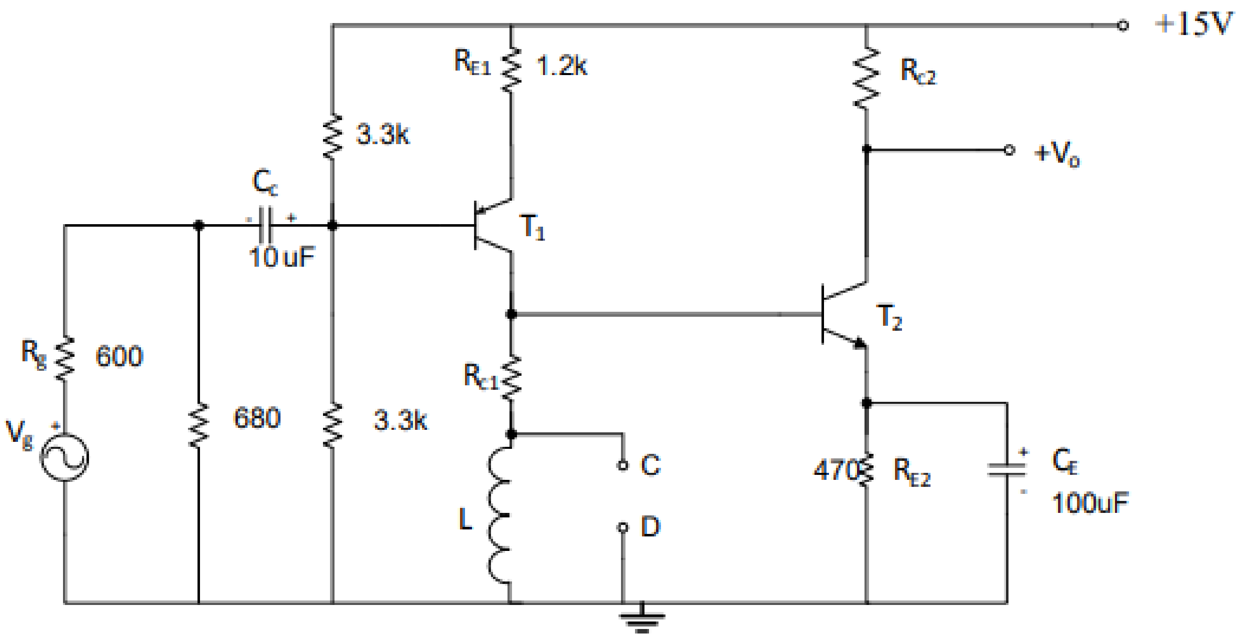


Figure - 2

3.1. PART A

Step 1:

Set up the parallel compensated circuit in Figure 2 by taking RC1 = 470 Ω and RC2 = 560 Ω. Npn transistor is 2N2222 and pnp transistor is 2N2907.

Make the DC analysis of the circuit by taking L = 0.

Fill in the table.

	V_C	V_B	V_E
T1			
T2			

Step 2:

At f = 1 KHz, change the level of the input signal to a level where you will get a smooth sine at the output. Observe the voltage gain by making the frequency of Vg signal 5 different values. 1kHz, 10 kHz, 100 kHz, 1 MHz and 10 MHz .

Note your results in the table

	1 kHz	10 kHz	100 kHz	1 MHz	10MHz
V2’					
V1					
Av					

In this case ;

Upper cutoff frequency =

Gain =

Step 3:

Observe the output signal by applying a 50 KHz square wave to the input. In this case;

Rising time =

Fall time =

3.2. PART B

Repeat all measurements for L = 40 uH. Add your results to the tables.

Step 1:

Fill in the table.

	V_C	V_B	V_E
T1			
T2			

Step 2:

	1 kHz	10 kHz	100 kHz	1 MHz	10MHz
V2’					
V1					
Av					

In this case;

Upper cutoff frequency =

Gain =

Step 3:

Observe the output signal by applying a 50 KHz square wave to the input. In this case;

Rising time =

Fall time =

3.3. Comparison of PART A and PART B

Comparison to part A;

a) How have fall and rise times changed in part B? Why?

b) Has the gain changed? Has the bandwidth changed? How have cutoff frequencies (lower cutoff / upper cutoff) changed?